

**EPA Superfund  
Record of Decision:**

**NAVAL SURFACE WARFARE CENTER - DAHLGREN  
EPA ID: VA7170024684  
OU 13, 14  
DAHLGREN, VA  
09/27/1999**

*OU 13*  
*OU 14*

**SITE 19 - TRANSFORMER DRAINING AREA (SOILS)  
AND  
SITE 29 - BATTERY SERVICE AREA  
(SOILS AND GROUNDWATER)**

**NAVAL SURFACE WARFARE CENTER  
DAHLGREN SITE  
DAHLGREN, VIRGINIA**

**RECORD OF DECISION**

**SEPTEMBER 1999**

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## **1.0 THE DECLARATION**

### **1.1 SITE NAME AND LOCATION**

**Site 19, Transformer Draining Area and Site 29, Battery Service Area  
Naval Surface Warfare Center Dahlgren Site  
Dahlgren, Virginia**

### **1.2 STATEMENT OF BASIS AND PURPOSE**

**This decision document focuses on remedial decisions and presents the selected remedial actions for Site 19 - Transformer Draining Area and Site 29 - Battery Service Area at the Naval Surface Warfare Center Dahlgren Site (NSWCDL) Dahlgren, Virginia. This determination has been made in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for both sites.**

**The Commonwealth of Virginia concurs with the selected remedy (see Appendix A).**

### **1.3 DESCRIPTION OF THE SELECTED REMEDY**

**The selected remedies for each site are as follows:**

#### **Site 19 Soil**

**No Further Action. PCB-contaminated soils were removed in 1994. Risk analysis conducted after the removal revealed that residual risks to human health and the environment were within acceptable limits.**

**Groundwater at Site 19 will be addressed concurrently with adjacent Site 40 at a future date.**


#### **Site 29 Soil and Groundwater**

**No Further Action. Contaminated soils were removed in 1994. Risk analysis conducted after the removal revealed that residual risks to human health and the environment were within acceptable limits.**


### **1.4 DECLARATION STATEMENT REGARDING STATUTORY DETERMINATIONS**

**It has been determined that the Selected Remedy (no further action) for soil at Site 19 and soil and groundwater at Site 29 is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost effective, and uses permanent solutions and alternative treatment technologies to the maximum extent practicable because previous removal actions have eliminated the need to conduct further remedial action.**

**The statutory preference for treatment as a principal element of a remedy is not applicable at these sites because the residual risks are within an acceptable range and no further action is needed. A 5-year review will not be required because constituents remaining onsite are at levels that do not require use restrictions.**

  
CAPT. Vaughn E. Mahaffey, USN  
Commanding Officer  
Naval Surface Warfare Center  
Dahlgren, Virginia

9/24/99  
Date

  
Abraham Ferdas, Director  
Hazardous Site Cleanup Division  
USEPA - Region III

9/27/99  
Date

## **2.0 DECISION SUMMARY**

This Record of Decision (ROD) is issued to describe the Department of the Navy's (NAVY) selected remedial action for both Site 19 - Transformer Draining Area and Site 29 - Battery Service Area, at the NSWCDL, in Dahlgren, Virginia (Figure 2-1). Both sites are Installation Restoration (IR) sites (Figure 2-2) located at the NSWCDL facility.

### **2.1 SITE 19 - NAME, LOCATION, AND DESCRIPTION**

The Transformer Draining Area is located in the south-central portion of the NSWCDL property, approximately 150 feet east of Caskey Road (Figure 2-3). Access to the site is provided via Caskey Road and a paved drive to the south of Building 120B, the Property Disposal Office, which forms the northern boundary of Site 19. The Building 120B Defense Reutilization and Marketing Office (DRMO) lot (Site 40), located in the northeastern portion of the site, is surrounded by an approximately 7-foot-high chain-link fence, and access is restricted. On the south are grassy areas.

The site is located on a relatively flat parcel of land, with elevations generally between 15 and 20 feet above mean sea level (msl) and nearly level slopes (less than 3 percent). The ground surface at Site 19 is characterized by a variety of surfaces, including pavement, gravel cover, and grass (Figure 2-3). Two concrete pads are located approximately 10 feet directly southeast of Building 120B. In the past, a common practice at NSWCDL was to drain transformer oil onto the ground behind Building 120B. The concrete pads are the reported location where the transformers were drained.

Surface drainage at the site is overland either southeast or southwest to drainage ditches. These ditches ultimately flow into storm sewers beneath the developed area to the southeast of Site 19.

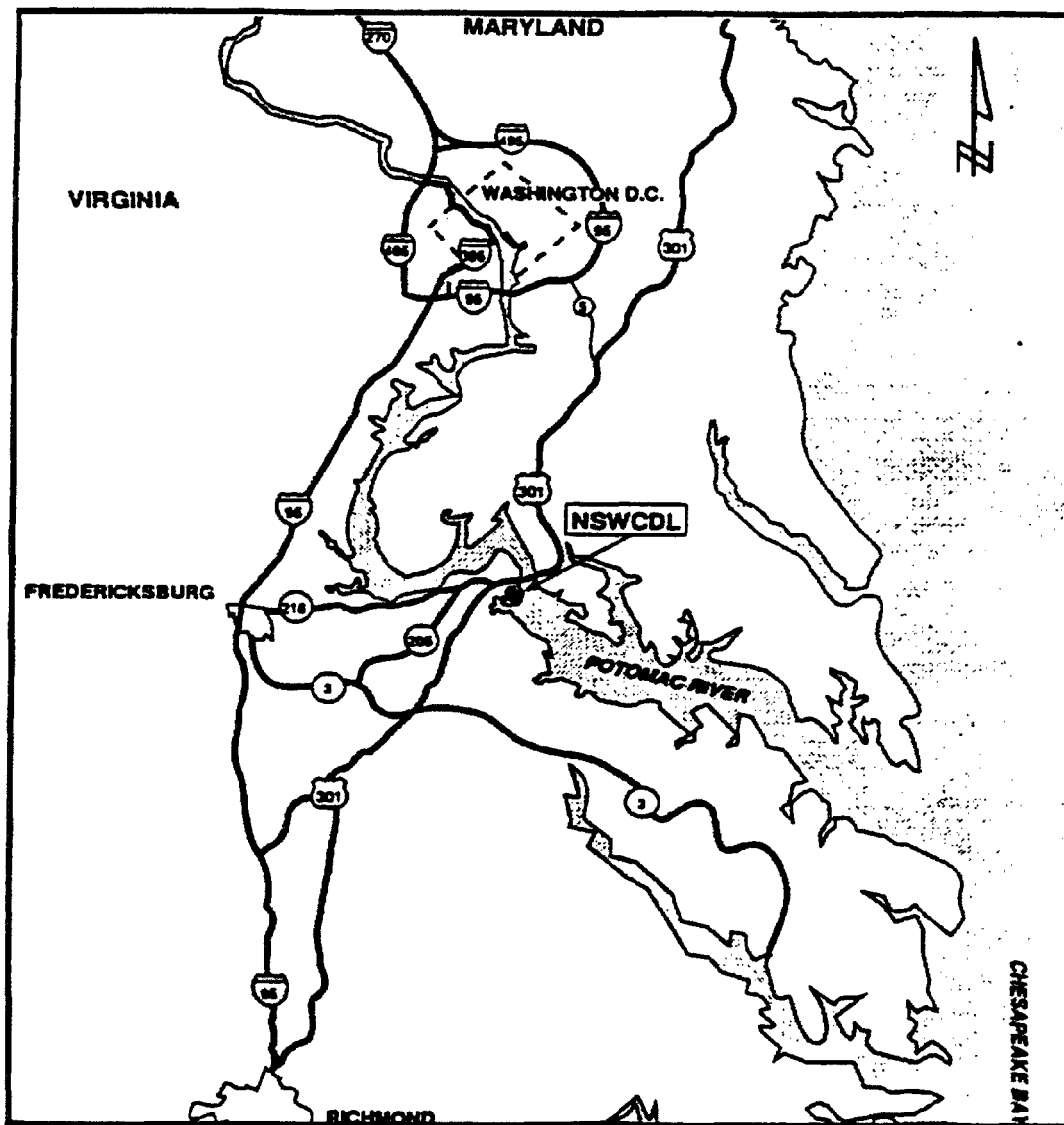
### **2.2 SITE 19 - HISTORY AND ENFORCEMENT ACTIVITIES**

#### **2.2.1 History of Site Activities**



The history of Site 19 has been developed from information provided in the Initial Assessment Study (IAS), the Confirmation Study, and an analysis of Environmental Photographic Interpretation Center (EPIC) aerial photographs. A summary of the site history is discussed in the following paragraphs.

Documentation of activity at Site 19 began as early as 1943 with the open storage of materials to the north, south, and east around what is presently identified as Building 120B. Drainage of transformer oil onto the ground behind Building 120B was a standard practice during the 1950s. The transformers were then turned in to the Property Disposal Office. The IAS conducted in 1981 estimated that approximately 1,000 gallons of oil were involved; however, no data were available regarding polychlorinated biphenyl (PCB) levels in the oil. Therefore, a Confirmation Study was recommended.

Ground-disturbing activities in the vicinity of Site 19 were first noted in the 1946 aerial photos and remain evident in more recent aerial photographs. In the 1946 imagery, evidence of a trench was observed approximately 75 feet southeast of Building 120B, the east end of which was located near a south-flowing drainage channel. A pit was noted approximately 30 feet north of the trench. Evidence of a second pit, containing an unknown liquid, was noted approximately 5 feet south of Building 120B and 15 feet west of the concrete pads. The trench and pits were no longer visible in either 1952 and 1958.

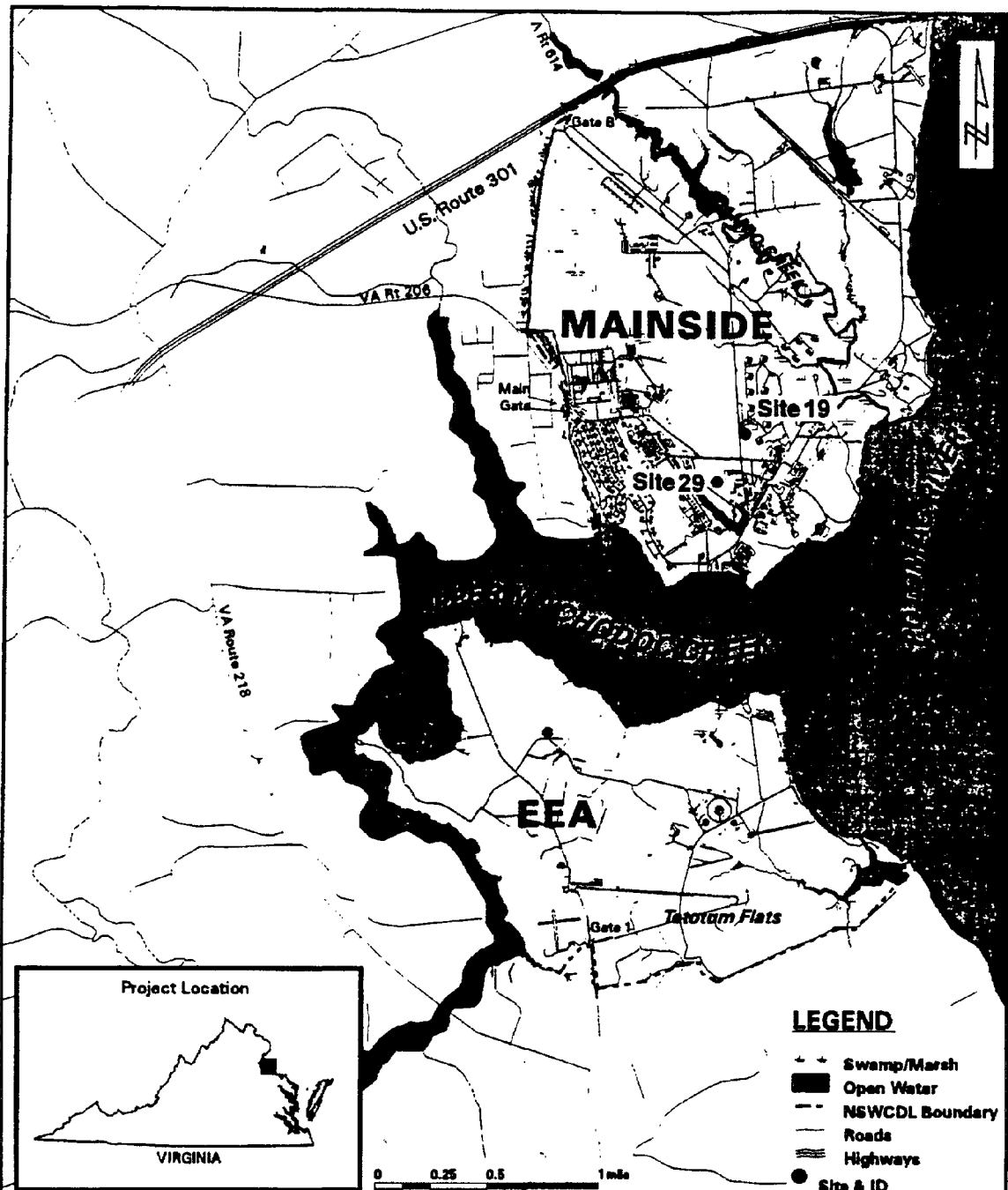



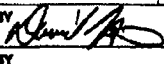
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CHECKED BY DM	DATE May 99		APPROVED BY <i>[Signature]</i>	DATE 05-28-99
COST/SCHED-AREA		LOCATION MAP	APPROVED BY	DATE
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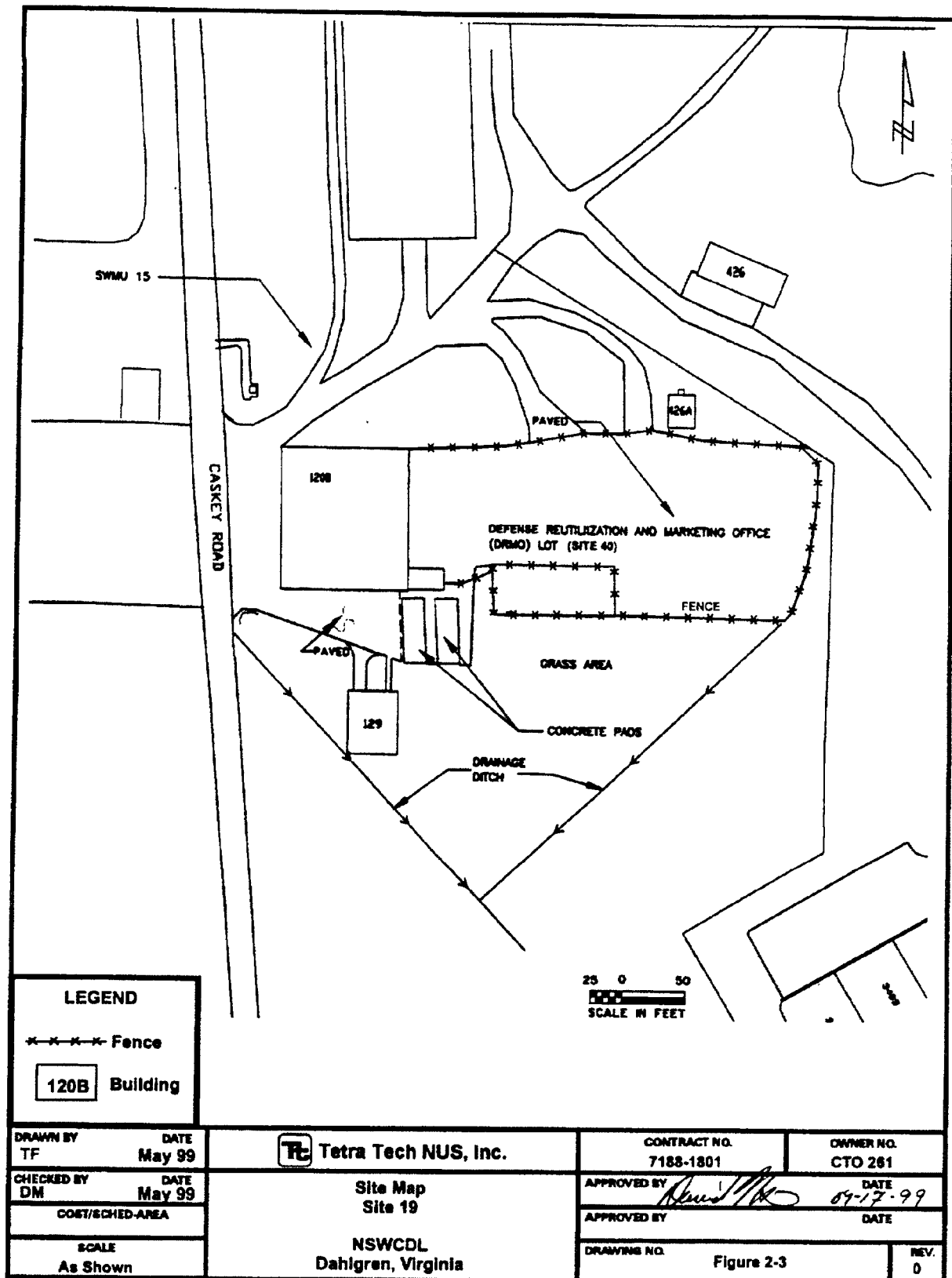




DRAWN BY TF	DATE May 99	 Tetra Tech NUS, Inc.	CONTRACT NO. 7188-1801	OWNER NO. CTO 261
CHECKED BY DM	DATE May 99		APPROVED BY 	DATE 05-28-99
COST/SCHED-AREA			APPROVED BY	DATE
SCALE AS SHOWN		SITE LOCATION MAP Sites 19 and 29 NSWCDL DAHLGREN, VIRGINIA	DRAWING NO. Figure 2-2	REV. 0

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Evidence of two trenches, one located 75 feet east of Building 120B and the other about 10 feet south of Building 120B, was noted in the 1960s images. An unknown liquid was evident in the eastern trench. Neither trench was visible in the 1969 photographs.

Ground stains were noted in the eastern storage area and on the south side of Building 120B in the late 1970s and through the 1980s. Drums were observed on Building 120B's east side in 1985 photographs. A fence, surrounding a rectangular mounded area, was constructed in 1990 approximately 40 feet south of Building 120B. A ground scar extending southeast from the fenced area to approximately 100 feet beyond the fence was noted in the 1990 image.

### **2.2.2 Previous Investigations and Response Actions**

The first investigation at Site 19 was the IAS in 1981. The IAS involved an onsite records review, site visit and personnel interviews. It was reported in the IAS that the normal procedure at NSWCDL during the 1950s was to drain transformer oil onto the ground behind Building 120B. As a consequence of the past draining of transformer oil potentially containing PCBs onto the ground, and due to the toxicity and persistence of PCBs, the IAS concluded that further investigation was warranted. A Confirmation Study was recommended to clarify whether PCB-containing liquids were disposed of on the ground surface at Site 19.

The Confirmation Study at Site 19 was conducted in 1983 and 1984. Soil and groundwater samples were taken from points around the concrete pads southeast of Building 120B, the supposed location where transformers were set to drain. Soil samples were collected from various depths to evaluate the potential presence of PCBs and to characterize any contaminant migration away from the pad. Samples were analyzed for PCBs and selected pesticides. In addition, monitoring wells were installed to determine the presence or absence of PCBs in groundwater.

Based on the field investigations and analytical results of the Confirmation Study, it was determined that the soil sampling at Site 19 had sufficiently delineated an area of shallow soil contamination adjacent to the concrete pad. Three sampling points were found to contain PCB concentrations over the Toxic Substances Control Act (TSCA) limit for disposal of 50 mg/kg. Contamination was limited to the upper 4 feet, based on detections of PCBs in samples from 2-foot depths but none from 4-foot depths, and consistent with the fact that PCBs do not migrate rapidly in most soils. The soil contamination did not appear to have resulted in any detectable contamination of either the deeper soils or the groundwater. The contaminated area was delineated to be approximately 20 x 50 feet, with a maximum depth not exceeding 4 feet.

A removal action was performed at the site in 1994 and consisted of removal and disposal of PCB contaminated soil. Soils contaminated with PCBs in concentrations exceeding 1 mg/kg were excavated and transported to EnviroSafe Services' TSCA approved landfill in Grandview, Idaho for disposal. Approximately 177 cubic yards of contaminated soil were removed. The entire excavation was approximately 2 feet deep. Soil sampling and analyses were conducted from the sides and bottom of the excavation to confirm that all soil with PCB concentrations greater than or equal to 1 mg/kg was removed. The excavation was then backfilled and spread with grass seed.

A Remedial Investigation (RI) was performed in 1995 and included a hydrogeologic investigation, contamination assessment, and risk assessment. In 1999, an addendum RI/Feasibility Study (FS) was performed to assess residual risk following the removal action and to evaluate potential remedial alternatives. Both studies are discussed in detail in Section 2.4.1 and 2.4.2.

### **2.2.3 Enforcement Actions**

No enforcement actions have been taken at Site 19. The Navy has owned this property since 1918 and is identified as the responsible party. NSWCDL was added to the National Priorities List (NPL) in 1992. The NPL is a list of the most contaminated hazardous waste sites in the United States.

#### **2.2.4 Highlights of Community Participation**

In accordance with Section 113 and 117 of CERCLA, the Navy provided a public comment period from July 21, 1999 through August 19, 1999 for the proposed remedial action, which is described in the Remedial Investigation/Feasibility Study and the Proposed Remedial Action Plan for Sites 19 and 29.

These documents were available to the public in the Administrative Record and information repositories maintained at the Smoot Memorial Library, King George, Virginia; the NSWCDL General Library, Dahlgren, Virginia; and the NSWCDL Public Record Room, Dahlgren, Virginia. Public notice was provided in *The Freelance Star* newspaper on July 19, 1999 and *The Journal* newspaper on July 14, 1999, and a public meeting was held in the King George Courthouse on July 28, 1999. No written comments were received during the comment period. Spoken comments and responses provided during the public meeting are presented in Appendix B. Additional community involvement, including Restoration Advisory Board (RAB) activities, are highlighted in Section 3.1.

#### **2.3 SCOPE AND ROLE OF RESPONSE ACTION FOR SITE 19**

Site 19 is one of many sites identified in the Federal Facility Agreement (FFA) for NSWCDL. In previous years, RODs have been issued for several other sites in accordance with the priorities established in the Site Management Plan (SMP). A removal was performed at Site 19 in 1994 to address PCB contaminated soils. This action follows the removal and provides closure for the site soils.

The selected remedy (no further action for soils) fits the Navy strategy to reduce risks at all NSWCDL sites with minimal long-term care. Site 19 soils are clean and require no future monitoring, allowing the Navy to focus its resources on the remaining NSWCDL sites. The remedial action identified in this ROD addresses contamination associated with Site 19 as identified in the Draft Final RI Reports, Engineering Evaluation/Cost Analysis Reports, Removal Action Reports, and the Addendum RI/FS Reports. The PCB-contaminated soil was removed from the site and the subsequent risk analyses indicated the remaining risks are within acceptable limits.

Future plans include addressing groundwater as part of adjacent Site 40.

#### **2.4 SUMMARY OF SITE 19 CHARACTERISTICS**

An RI/FS was completed in phases for Site 19. Sampling activities, consisting of soil sampling and the installation and sampling of groundwater monitoring wells, were completed in 1994. Additional soil sampling was performed before and after the removal action was completed in 1994. A draft final RI was prepared in 1995. An addendum RI/FS was prepared in 1999.

##### **2.4.1 1995 Remedial Investigation**

The RI at Site 19 included a hydrogeologic investigation, contamination assessment, and risk assessment. The hydrogeologic investigation included the installation and sampling of two groundwater-monitoring wells and the sampling of four existing groundwater-monitoring wells. Physical descriptions of the subsurface, a monitoring well elevation and location survey, groundwater-level measurements, and two hydraulic conductivity tests were also included in the hydrogeologic investigation. Site 19 is underlain by the Tabb Formation, which is composed of sand, silt, and clay. Groundwater elevations based on March 1994 measurements were approximately 13 feet above msl. The shallow aquifer exists within a relatively thin sand layer at Site 19 (approximately 10 feet thick), and predominant groundwater flow at the site is to the east. The estimated hydraulic conductivities at Site 19 were  $7.29 \times 10^{-3}$  cm/sec and  $1.5 \times 10^{-3}$  cm/sec.

The contamination assessment included the collection and analysis of samples from soil and groundwater. Five surface soil samples, six subsurface soil samples, two samples from the concrete pads, and

groundwater samples from six wells (two new and four existing wells) were collected during the field investigation at Site 19.

Based on the results of the RI, previous investigations, and historical information, PCBs were identified as contaminants of primary concern at Site 19 because of potential human health risks. Risks to ecological receptors were likely to be minimal because of the limited distribution of contaminants, and Site 19 provides minimal habitat for ecological receptors because of the heavy development and level of human activity in the area. Soil sampling conducted during the RI confirmed the presence of PCB contamination east of Building 120B, as previously identified in the Confirmation Study. Surface soil, subsurface soil, and groundwater samples collected beyond the previously identified area did not indicate contaminant migration had occurred.

#### **2.4.2      1999 Remedial Investigation/Feasibility Study**

Follow-up remedial investigation activities consisting of a human health risk analysis were performed to determine whether further action was required. These results are summarized below.

##### **2.4.2.1      Sources of Contamination**

Extensive soil sampling was conducted to identify the extent of PCB contamination in the area where transformer oil was drained onto the ground during the 1950s. The amount of oil involved was estimated to be approximately 1,000 gallons. Based on multimedia sampling, it was determined that the PCB contamination was confined to the soil over an area covering approximately 25 ft. by 70 ft. to a depth of 2 ft. The PCB-contaminated soils were removed and disposed offsite in 1994 as part of the removal action.

##### **2.4.2.2      Description of Contamination**

Soil sampling conducted during the Confirmation Study at Site 19 identified an area of shallow PCB contaminated soil. No PCBs were detected in groundwater samples. The objective of the RI at Site 19 was to determine the extent of contamination in both surficial and deeper soils and to verify that activity at the site has not impacted groundwater quality. Phase 1 field investigation activities involved inspection/evaluation and rehabilitation of the four existing IR monitoring wells at the site. Phase 2 field activities included the installation of two new monitoring wells and the analysis of groundwater samples from new and existing wells, soil sampling, and sampling of concrete chips from the existing concrete pads.

The primary objective of the soil investigation at Site 19 was to identify the presence or absence of PCBs and other contaminants in the vicinity of the transformer draining area. The objective of the groundwater investigation was to determine whether PCBs had migrated from shallow soils into the surficial aquifer. Surface water and sediment samples were not collected during the RI investigation because of the distribution of contamination in the soils, the immobile nature of PCBs, and the flat topography surrounding Site 19. Transport of contaminated soil via surface runoff was not expected to be significant.

PCBs were the contaminants of primary concern at Site 19 based on previous investigations and historical information. In addition to PCBs, samples were also analyzed for volatile and semivolatile compounds, metals, cyanide, and total petroleum hydrocarbons (TPHs). Additional analyses were necessary because it is not known what other materials were stored in the area. A Toxicity Characteristic Leaching Procedure (TCLP) was completed on two soil samples to aid in evaluation of disposal options for soil at Site 19.

RI soil samples that were collected outside the PCB-contaminated area where the removal action occurred at Site 19 are shown in Figure 2-4. Post-removal verification sampling locations are shown in Figure 2-5. Table 2-1 lists the chemicals of potential concern (COPC) for each medium and the maximum concentration detected. The results of the sampling and analyses are presented below.

Concentrations of several metals, including aluminum, arsenic, cadmium, chromium, iron, manganese, and vanadium, detected in soils are identified in Table 2-1. The arsenic and iron concentrations reflect background conditions based on statistical analyses. Low-level Aroclor-1260 concentrations (less than the 1.0 mg/kg cleanup level) were detected in soil (2 ft. below ground surface [bgs]) after the removal action was completed. The Aroclor-1260 contamination appears to be related to the past transformer draining practices, whereas the metals contamination does not.

#### **2.4.3.3      Contaminant Migration**

The primary contaminant of concern at Site 19 was Aroclor-1260 in soils. Aroclor-1260 does not appear to have migrated from the removal area via overland flow because none were detected in surface soil samples taken outside the removal area. There also is no evidence of subsurface migration of Aroclor-1260 through leaching, because no Aroclor-1260 was detected in groundwater and none exceeded 1.0 mg/kg in subsurface soil 2-ft bgs. Subsurface soils at Site 19 are only moderately permeable and include a clay layer, helping prevent the vertical migration of Aroclor-1260. Aroclor-1260 is unlikely to migrate via overland flow because the removal area was backfilled to existing grade with clean soil, Aroclor-1260 is only slightly soluble in water, and the site topography is relatively flat.

Aroclor-1260 is not easily biodegradable and persists in the environment. The persistence of PCBs is dependent on the number of chlorine atoms that comprise the compound. PCBs with one or two chlorine atoms degrade more readily than PCBs with three to six chlorine atoms. Aroclor-1260 contains more chlorine by weight (60 percent) than any other commercially manufactured PCB product and therefore would be expected to persist in the environment for a long time.

### **2.5              CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES**

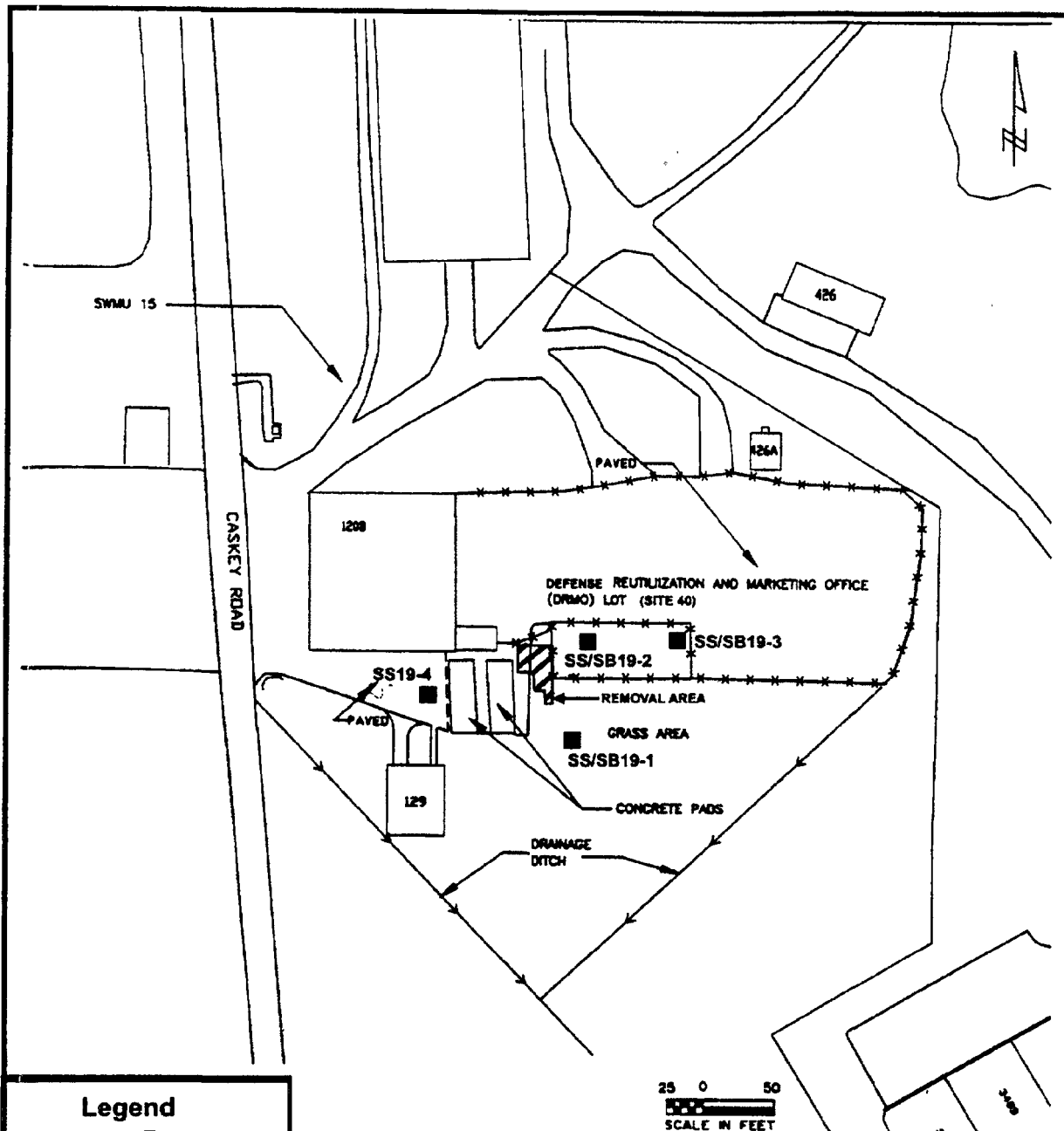
Site 19 is located in the south-central portion of the Mainside, about 150 feet east of Caskey Road. The site is nearly level. A portion of the site is vegetated with grass and the remainder is covered with pavement or gravel. The site is bordered on the north by Building 120B, which is regularly occupied. A portion of this site is enclosed by the fence surrounding the DRMO Lot (Site 40). Access to the majority of Site 19 from Caskey Road (which borders the site on the west side) is unrestricted. The site is bordered to the south and east by grassy fields. The base airstrip lies across Caskey Road immediately west of the site.

A portion of Site 19 lies within the fenced DRMO Lot and is entered by DRMO personnel on a sporadic basis usually on a forklift to place or remove an item from storage. Other portions of the site have unrestricted access and have occasional foot traffic and grounds maintenance activities performed. Caskey Road is used by base personnel for jogging and bike riding.

Site 19 is currently an industrial use area and is anticipated to remain an industrial use area in the future. The mission of the base is currently expanding and future potential for base closure and conversion to residential land use, is considered to be minimal. Groundwater in the shallow aquifer beneath Site 19 is not a current source of drinking water. Groundwater contaminants will be evaluated in the future in conjunction with an adjacent site (Site 40).

### **2.6              SUMMARY OF SITE 19 RISKS**

The ecological and human health risks associated with exposure to contaminated media at Site 19 were evaluated in the Addendum RI/FS Report,

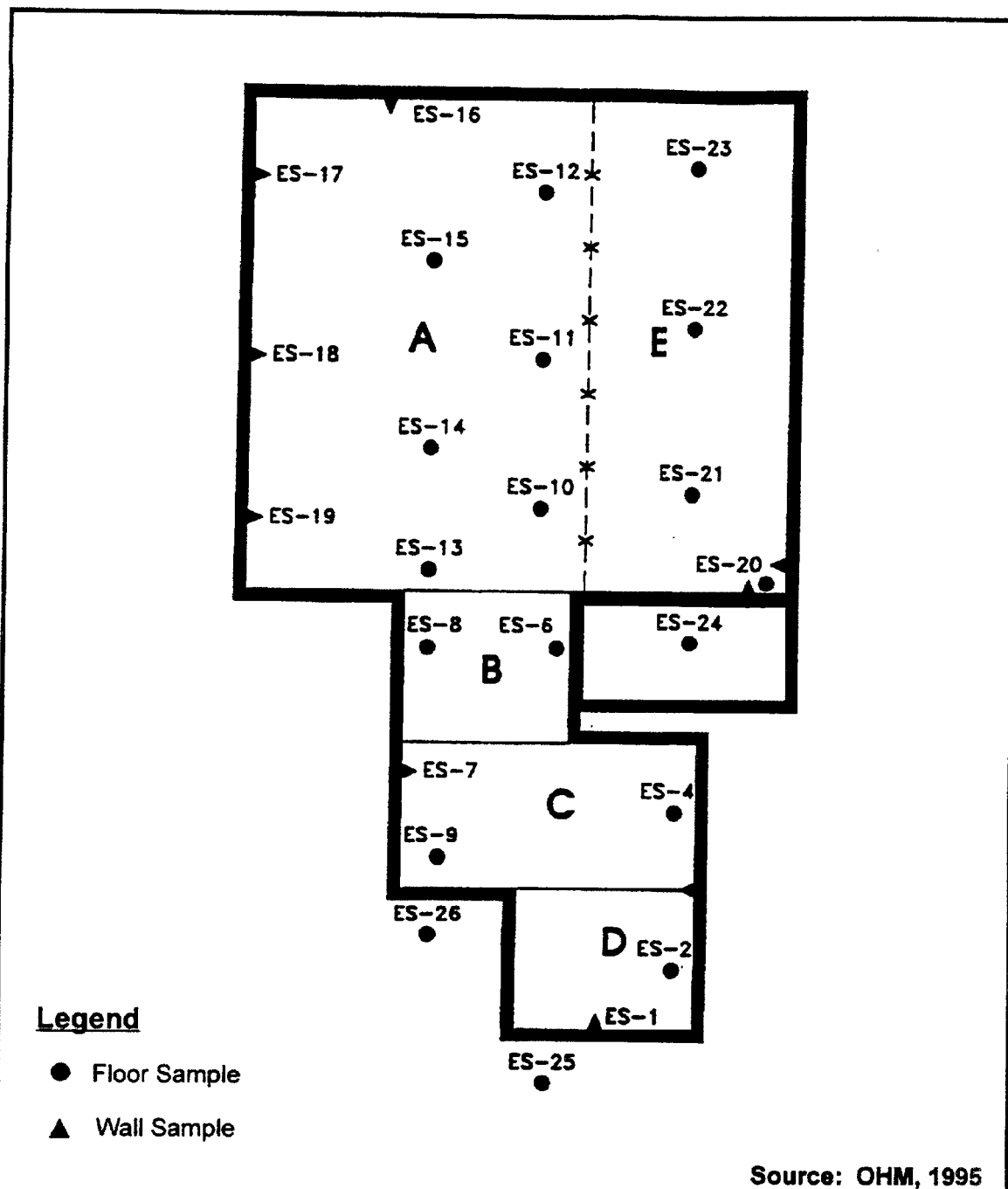




Legend	
*****	Fence
120B	Building
■	Soil Sample Location

DRAWN BY TF	DATE May 99	Tetra Tech NUS, Inc.	CONTRACT NO. 7188-1801	OWNER NO. CTO 261
CHECKED BY DM	DATE May 99	RI Sampling Locations Site 19	APPROVED BY 	DATE 09-17-99
COST/SCHED-AREA		NSWCDL Dahlgren, Virginia	APPROVED BY	DATE
SCALE As Shown			DRAWING NO. Figure 2-4	REV. 0

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DRAWN BY TF	DATE May 99	 Tetra Tech NUS, Inc.  Post Removal Verification Sampling Locations Site 19  NSWCDL Dahlgren, Virginia	CONTRACT NO. 7188-1801	OWNER NO. CTO 261
CHECKED BY DM	DATE May 99		APPROVED BY 	DATE 05-28-99
COST/ESTIMATED AREA			APPROVED BY	DATE
SCALE As Shown			DRAWING NO. Figure 2-5	REV. 0

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**TABLE 2-1**

**MAXIMUM DETECTED CONCENTRATIONS FOR COPCs (POST REMOVAL)  
SITE 19: TRANSFORMER DRAINING AREA  
NSWCDL, DAHLGREN, VIRGINIA**

<b>SURFACE SOILS</b>	
<b>Metals (mg/kg)</b>	
Aluminum	20,900
Arsenic	5.4
Chromium	42.2
Iron	24,000
Manganese	2,220
Vanadium	60.5
<b>SUBSURFACE SOILS</b>	
<b>Metals (mg/kg)</b>	
Aluminum	102,000
Cadmium	4.1
Chromium	105
Iron	37,000
Vanadium	125
<b>Target Compound List (TCL) Pesticides/PCBBs (mg/kg)</b>	
Aroclor-1260	0.81

### **2.6.1      Environmental Evaluation**

The PCB Aroclor-1260, aluminum, arsenic, and manganese are present in Site 19 surface soils in concentrations greater than their respective soil background and ecological risk screening concentrations. Arsenic concentrations are not significantly different from background based on statistical analysis. The three metals were detected in all five samples collected from this site, whereas Aroclor-1260 was only present in one sample. Aluminum concentrations exceeded the conservative ecological risk screening concentration used for this contaminant in all surface soil samples collected at this site. Arsenic and manganese exceeded their ecological risk screening concentration in one and two samples, respectively. These data suggest that although the presence of these contaminants represents a potential risk to surface-dwelling ecological receptors, actual risk posed to ecological receptors is likely to be minimal. Not only as a result of the limited distribution of contaminants, but also because of the heavy development in this area and the high level of human activity, this site represents minimal habitat for ecological receptors. These conditions limit the likelihood that ecological receptors will come in contact with these contaminants and thus significantly reduce the risks associated with these contaminants.

### **2.6.2      Human Health Risks**

#### **Exposure Pathways and Potential Receptors**

Base workers, construction workers, and onsite residents (children and adults) were evaluated as potential receptors in the quantitative risk assessment. Base workers were considered for current and future conditions. Construction workers and onsite residents were evaluated for future conditions only. Although the potential for the base to be converted to residential land use is minimal, potential risks to future onsite residents were quantified for purposes of completeness. Under the current and future land use scenarios considered at Site 19, the exposure routes were incidental ingestion of soil and dermal contact with soil.

The potential groundwater exposure route was not considered because contaminants in groundwater will be addressed in conjunction with an adjacent site in the future. The potential inhalation of volatiles from soil and inhalation of fugitive dust exposure route was not considered because the site is partially vegetated, relatively flat, and/or covered with asphalt or gravel. Volatile organics are not COPCs at Site 19, and fugitive dust emissions would be minimal under current land use conditions. It is assumed that good construction practices and moist soil at Site 19 (resulting from the shallow water table) will minimize emissions of fugitive dust.

#### **Exposure Assessment**

The COPCs that were evaluated and their maximum exposure point concentrations are presented in Table 2-2. Exposure point concentrations are used to determine potential human health risks.

#### **Toxicity Assessment**

The toxicity assessment characterizes the nature and magnitude of potential health effects associated with human exposure to COPCs at each site. Quantitative risk estimates for each COPC and exposure pathway are developed by integrating chemical-specific toxicity factors with estimated chemical intakes discussed in the previous section.

Quantitative risk estimates are calculated using cancer slope factors (CSFs) for COPCs exhibiting carcinogenic effects and reference doses (RfDs) for COPCs exhibiting systemic (noncarcinogenic) effects. A summary of the RfDs and CSFs used in the baseline human health risk assessment is presented in Table 2-3.

TABLE 2-2

**CHEMICALS OF POTENTIAL CONCERN AND EXPOSURE POINT CONCENTRATIONS<sup>(1)</sup>**  
**SITE 19, TRANSFORMER DRAINING AREA**  
**NSWCDL, DAHLGREN, VIRGINIA**

	Organics		Inorganics	
	Chemical	Exposure Point Concentration <sup>(1)</sup> (mg/kg)	Chemical	Exposure Point Concentration <sup>(1)</sup> (mg/kg)
Surface Soil (mg/kg)				
Construction Worker, Base Worker, and Future Residential Scenarios	None	NA	Aluminum Arsenic Chromium Iron Manganese Vanadium	20,900 5.4 42.2 24,000 2,220 60.5
Subsurface Soil (mg/kg)				
Construction Worker, Base Worker, and Future Residential Scenarios	Aroclor-1260	0.81	Aluminum Cadmium Chromium Iron Vanadium	102,000 4.1 105 37,000 125

- 1 Maximum concentrations are used as exposure point concentrations for soil for the Reasonable Maximum Exposure (RME) and Central Tendency Exposure (CTE) because, with the exception of the Aroclors, the post-removal soil database contains less than 10 samples. The maximum detected Aroclor-1260 concentration was used as the exposure point concentration for Aroclors because the information necessary to calculate the 95 percent upper confidence limit on the mean was not available (i.e., sample quantitation limits for nondetect results were not available).

TABLE 2-3

**DOSE-RESPONSE PARAMETERS  
SITE 19: TRANSFORMER DRAINING AREA  
NAVAL SURFACE WARFARE CENTER, DAHLGREN, VIRGINIA**

Chemical	RfD Oral <sup>(1)</sup> (mg/kg-day)	RfD Inhalation <sup>(1)</sup> (mg/kg-day)	CSF Oral <sup>(1)</sup> (kg-day/kg)	CSF Inhalation <sup>(1)</sup> (kg-day/mg)	Gastrointestinal Absorption Factor	RfD Dermal (mg/kg-day)	CSF Dermal (kg-day/mg)	Weight of Evidence
Aroclor-1260	NA <sup>(2)</sup>	NA	1.0E+0:CTE <sup>(4)</sup> 2.0E+0:RME <sup>(4)</sup>	1.0E+0:CTE <sup>(4)</sup> 2.0E+0:RME <sup>(4)</sup>	NA	NA	NA	B2
Aluminum	1E+0 <sup>(3)</sup>	1E-3 <sup>(3)</sup>	NA	NA	0.05 <sup>(6)</sup>	5.0E-2	NA	NA
Arsenic	3E-4	NA	1.5E+0	1.51E+1	0.95 <sup>(7)</sup>	2.85E-4	1.58E+0	A1-Inhalation
Cadmium	5E-04	NA	NA	6.3E+0	0.05	2.5E-5	NA	B1-Inhalation
Chromium VI (hexavalent)	3E-3	3E-5	NA	4.1E+1 <sup>(5)</sup>	0.01 <sup>(8)</sup>	3.0E-5	NA	A1-Inhalation
Iron	3E-1 <sup>(3)</sup>	NA	NA	NA	NA	3.0E-1	NA	NA
Manganese - soil	1.4E-1 <sup>(9)</sup>	1.43E-5	NA	NA	0.03 <sup>(10)</sup>	4.2E-3	NA	D
Vanadium	7E-3	NA	NA	NA	0.05 <sup>(6)</sup>	3.5E-4	NA	D

1 USEPA, 1999a (IRIS), unless otherwise noted.

2 NA - Not available/applicable. There are currently no published values for parameters.

3 USEPA-NCEA provisional value, 1998a

4 Values for high risk and persistence based on USEPA guidance for evaluating carcinogenic risks from PCBs (USEPA, 1996b).

5 USEPA, 1997b

6 Assumed default value (USEPA, 1989)

7 ATSDR, 1991

8 ATSDR, 1993

9 USEPA, 1984

10 USEPA Region I Guidance, USEPA Risk Updates, November 1996d. "The revised RfD for manganese is for the total oral intake of manganese. This value is 0.14 mg/kg/day . . ." "For most RCRA and Superfund risk assessments neonates are unlikely to be exposed to significant amounts of soil. Therefore, a modifying factor of one (1) is appropriate. Assuming exposure to a young child under a residential scenario, a hazard index of 1 for manganese in soil would correspond to a soil concentration of 5,500 mg/kg." Note that the maximum reported concentration of manganese at Site 19 is 2,200 mg/kg.

USEPA's Weight of Evidence Classifications:

A1 Known human carcinogen.

B1 Probable human carcinogen; limited human data are available.

B2 Probable human carcinogen; sufficient evidence in animals and inadequate or no evidence in humans.

C Possible human carcinogen.

D Not classifiable as to human carcinogenicity.

CSFs and RfDs developed by USEPA are based on ingestion (oral) or inhalation routes of exposure rather than dermal contact. Therefore, these values reflect administered doses rather than absorbed doses. USEPA guidance on assessment of dermal exposure (USEPA, 1992b) recommends that oral toxicity factors used in dermal risk assessment be adjusted for gastrointestinal absorption efficiency, if such data are available. The methodology for the adjustment is presented in Appendix A to the USEPA Risk Assessment Guidance to Superfund, Part A (USEPA, 1989). The dermal RfDs and CSFs adjusted for GI absorption are listed in Table 2-3.

## Chromium Toxicity

Chromium was identified as a COPC in surface soil and subsurface soil at Site 19. Analytical results for this chemical are reported as total chromium. Chromium may be present in different oxidation states. The hexavalent state, which is a less common state of chromium in environmental matrices, is the most toxic form of chromium. No analyses were performed to distinguish between the specific chromium oxidation states present at the site. For the purposes of this risk assessment, it is conservatively assumed that chromium is present in the hexavalent state.

Toxicity profiles for COPCs are presented in Appendix C.

## Risk Characterization

Excess lifetime cancer risks are determined by multiplying the intake level with the cancer slope factor. These risks are probabilities that are generally expressed in scientific notation (e.g.,  $1 \times 10^{-6}$ ). An excess lifetime cancer risk of  $1 \times 10^{-6}$  indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime, under the specific exposure conditions at a site.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium (i.e., water, soil, or air) is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminants RfD). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the hazard index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

**Base Worker.** The cumulative noncancer HIs for ingestion of and dermal contact with soils for Site 19 under industrial land use conditions are less than 1, which indicates that no significant hazards are associated with soils at Site 19.

The cumulative ingestion and dermal contact cancer risk is  $1.8 \times 10^{-6}$ , under a "reasonable maximum exposure" (RME) scenario. Although the incremental cancer risk for the base worker slightly exceeded  $1 \times 10^{-6}$ , it is within USEPA's target risk range of  $1 \times 10^{-4}$  to  $10 \times 10^{-5}$ .

**Construction Worker.** The cumulative noncancer HIs for ingestion of and dermal contact with soils for Site 19 under industrial land use conditions are 1.2 for the RME. The HI for the RME exceeds one primarily as a result of the ingestion of aluminum and iron in subsurface soil. The RfDs for aluminum and iron are not based on any health effects but rather on recommended daily allowances. If aluminum and iron were eliminated as COPCs, the HI calculated for the construction worker would be 0.36, which is less than one. If the toxicity criterion for trivalent chromium was used in the risk assessment, the HI calculated for the construction worker would be 0.96, which is also less than one. A HI of less than one indicates no significant hazards. Also, HIs calculated on target organ/endpoint specific basis do not exceed unity indicating that adverse health effects are not anticipated for construction workers exposed to subsurface soil.

The cumulative ingestion and dermal contact cancer risk is  $4.1 \times 10^{-7}$ , under a RME scenario, which is less than USEPA's target risk range of  $1 \times 10^{-4}$  to  $1 \times 10^{-6}$ .

**Future Resident.** The cumulative noncancer HIs for ingestion of and dermal contact with soils for Site 19 under hypothetical residential land use conditions are 2.6 for the RME. The HI for the RME exceeds one primarily as a result of the ingestion of aluminum, arsenic, chromium, and iron in soil. The RfDs for aluminum and iron are not based on any health effects but rather on recommended daily allowances. It was conservatively assumed that all chromium is hexavalent chromium, which significantly overestimates the potential risks from exposure to chromium. If aluminum and iron were eliminated as COPCs, and chromium was assumed to be trivalent chromium, the HI calculated for the hypothetical resident is 0.7, which is less than one. A HI of less than one indicates no significant hazards.

The total residential incremental lifetime cancer risk based on cumulative ingestion and dermal contact with soils is  $1.4 \times 10^{-5}$ , under a RME scenario, which is within USEPA's target risk range of  $1 \times 10^{-4}$  to  $1 \times 10^{-6}$ .

### Uncertainty Analysis

The major sources of uncertainty specific to post-remedial conditions at Site 19 include:

- The exposure point concentrations for iron and arsenic (noncarcinogenic risk drivers for soil) may reflect background conditions. In addition, the RfDs for iron and aluminum are not based on any health effects but rather on recommended daily allowances. Consequently, some USEPA Regions (e.g., USEPA Region I) do not advocate quantitative risk assessment of these metals. If these constituents (aluminum, arsenic, and iron) are eliminated as COPCs in surface soil, the HI for the most sensitive receptor, the hypothetical future child resident would be 0.83, which is less than the USEPA benchmark of one. If aluminum and iron are eliminated as COPCs in subsurface soils, the HI calculated for the hypothetical child resident would be 1.6. Additionally, if chromium was evaluated as trivalent chromium, the HI for the child exposed to surface soil would be 0.61, and the HI calculated for the child exposed to subsurface soil would be 0.44.
- An evaluation of the risk estimates for chromium indicate that the risk for dermal contact with soil contributes more to the total HI for chromium than risk estimates for the ingestion route of exposure. The risk estimate for dermal contact results from a conservative oral absorption factor (0.01) provided by USEPA Region III that has been used to calculate a dermal RfD for chromium. The USEPA has recently published an oral absorption value of 0.025 for hexavalent chromium. Consequently, risks from dermal absorption to chromium may be overestimated by a factor of 2.5.
- Arsenic, the only carcinogenic constituent identified as a COPC in surface soil, may be present at concentrations reflecting background conditions. If arsenic was eliminated as a COPC in surface soil, a cancer risk estimate would not be calculated for surface soils.

### Summary and Conclusions

The following items summarize the results of a human health risk assessment conducted based on the post-removal action soil database for Site 19:

1. Hazard indices calculated for base workers who are exposed to soil do not exceed one indicating that adverse health effects are not anticipated under the conditions established in the exposure assessment. Cancer risk estimates developed for this receptor exceed  $1.0 \times 10^{-6}$  only when arsenic concentrations in surface soil are evaluated. However, the

results of statistical comparisons of site concentrations with background concentrations indicate that the arsenic concentrations in the Site 19 soils are reflective of background conditions.

2. HIs calculated for the construction worker exposed to surface soil and subsurface soil are 0.61 and 1.2 for the RME receptor exposed to surface and subsurface soils, respectively. The primary noncarcinogenic risk drivers are aluminum and iron; however, significant uncertainty is reported for the available RfDs for aluminum and iron. The provisional oral RfDs available for these metals are based on allowable daily intakes for human nutrition, instead of an adverse health effect. Additionally, these metals do not affect the same target organs. Consequently, target organ/effect specific HIs would not exceed unity. Cancer risk estimates for the construction worker do not exceed  $1\text{E-}6$ .
3. A hypothetical future resident was evaluated for purposes of completeness. The HIs calculated assuming exposure to surface and subsurface soil were 2.5 and 4.9, respectively. Arsenic (surface soil), aluminum, iron, and chromium are the primary risk drivers. However, HIs calculated for these metals overestimate the site-related, noncarcinogenic risk: a) Arsenic concentrations in the surface soil reflect background conditions, b) The provisional RfDs available for aluminum and iron are not based on adverse health effects, and c) The risk assessment was prepared assuming that 100 percent of the chromium was present in the soil in the hexavalent state.
4. Cancer risk estimates developed for the hypothetical future resident (RME case) are  $1.4 \times 10^{-5}$  and  $4.1 \times 10^{-6}$  for surface and subsurface soils, respectively. Cancer risk estimates developed for the CTE case are  $1.7 \times 10^{-6}$  and  $3.0 \times 10^{-7}$  for the surface and subsurface soils, respectively. Arsenic, detected at concentrations reflecting background, is the only COPC contributing to the risks calculated assuming surface soil exposure. Aroclor-1260, detected at concentrations less than the current USEPA soil screening level (SSL) for PCBs (for residential land use), is the only contaminant of potential concern (COPC) contributing to the risks calculated assuming subsurface soil exposure.

The cancer risk estimates for the human receptors evaluated are within or less than the USEPA target risk range of  $1 \times 10^{-4}$  to  $1 \times 10^{-6}$ . The maximum concentration of the primary site contaminant (i.e., the PCBs) is less than the USEPA SSL for residential land use. The HIs calculated for the base worker and the construction worker do not exceed one. HIs calculated for the hypothetical future resident, which are less than five, are expected to overestimate the site-related, noncarcinogenic risk to this receptor.

The RI conducted for Site 19 indicated PCBs in soil were the only contaminant that warranted remedial action. Subsequently, the PCB-contaminated soil was excavated and disposed of offsite. Sampling data was collected to verify the removal action achieved its objective. This data was evaluated in a revised risk assessment which indicated remaining risks are acceptable.

Therefore "no further action" is the selected remedy for soils at Site 19. Groundwater will be further evaluated in conjunction with an adjacent site (Site 40).

## **2.7 DOCUMENTATION OF SIGNIFICANT CHANGES**

The selected remedy is the same alternative identified as the recommended alternative in the Proposed Remedial Action Plan which was presented to the public at the public meeting held July 28, 1999.

There were no significant changes to the recommended remedial action alternative in the Proposed Plan.

## **2.8 SITE 29 - NAME, LOCATION, AND DESCRIPTION**

The Battery Service Area, located off Caskey Road in the south-central portion of the NSWCDL, Mainside, consisted of a former unlined neutralization pit used for disposal of battery acid resulting from handling and recharging of sulfuric acid batteries (Figure 2-6). The exact depth and width of the pit are unknown. The former pit, located behind Buildings 1121 and 338, was paved over and the location is used as a service area. Access to the pit was through a concrete manhole type cover. The pit was closed in the mid-1980s and was not backfilled, although the manhole was covered with soil. The site, which is heavily developed and composed of closely spaced structures and pavement, is used by the Public Works Department mainly for the maintenance of heavy equipment and transportation vehicles. A grease rack is located approximately 5 feet west of the former pit and is currently used for the maintenance and lubrication of heavy machinery. The majority of the base maintenance vehicles (e.g., plows, dump trucks, buses, etc.) are parked approximately 200 feet north of the site. The base golf course, which is separated from the Public Works area by a chain-link fence, is located approximately 150 feet west of the site. The base Cooling Pond, Site 55, is located approximately 250 feet south of the site. Access to the site is provided via Caskey Road, which is located approximately 200 feet east of the site.

Elevations in the site vicinity are between 10 and 20 feet msl. Slopes are gentle (less than 3 percent), and surface drainage is overland to storm drains, which discharge to the Cooling Pond (Site 55).

Several Solid Waste Management Units (SWMUs) are in the vicinity of Site 29, including the following:

- Cooling Pond (Site 55);
- Battery Locker Acid Draining Area (SWMU 98);
- Building 155 Auto Shop Waste Oil Filter and Underground Storage Tank (UST) (SWMU 101);
- Oil/Water Separator (OWS) 1121 -Old (SWMU 128);
- Building 1121 Former Waste Oil LIST (SWMU 78);
- SWMU 127: OWS 1121-300, OWS 115-350, OWS 402-30,000, and OWS 486-1000 (SWMU 127).

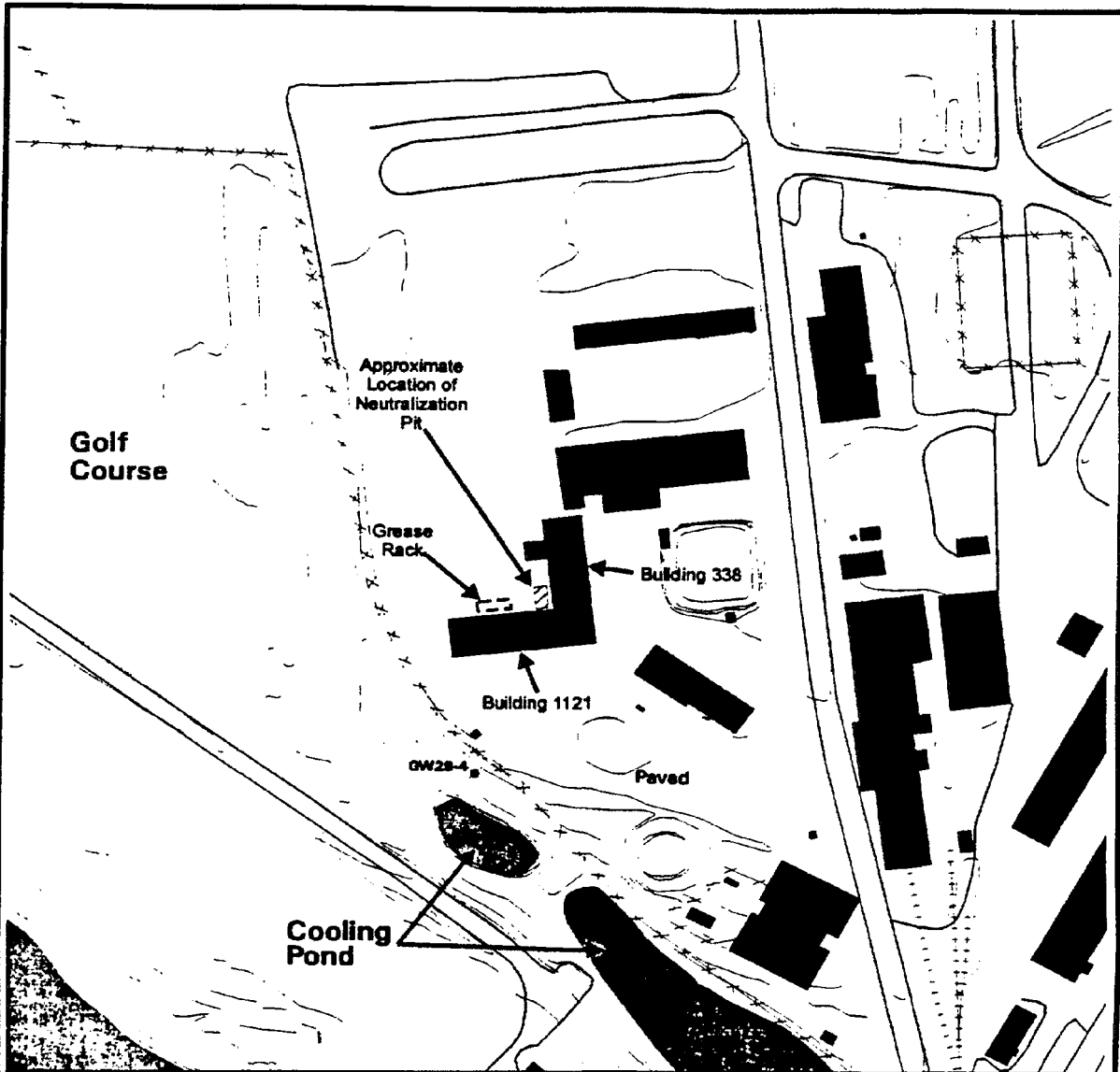
## **2.9 SITE 29 - HISTORY AND ENFORCEMENT ACTIVITIES**


### **2.9.1 History of Site Activities, Previous Investigations and Previous Response Actions**

The site history for Site 29 has been developed from information provided in the IAS, the Confirmation Study, and an EPIC analysis of aerial photographs. A summary of the site history is discussed in the following paragraphs.

Information contained in the IAS was obtained through onsite records review, site visits, and personnel interviews conducted during 1981. Waste battery acids were reported to have discharged into an underground tank at Site 29 at the rate of approximately 10 to 15 gallons per month. The tank was apparently never emptied and, despite numerous inquiries by Fred C. Hart Associates, Inc. no indication showed where the tank drained. At the time of the IAS, a dye test program was being developed and implemented by the base to determine discharge from the tank. The IAS did not recommend a Confirmation Study at Site 29 because of the planned dye test program.





DRAWN BY TF	DATE May 99	 Tetra Tech NUS, Inc.  Site Map Site 29  NSWCDL Dahlgren, Virginia	CONTRACT NO. 7188-1801	OWNER NO. CTO 281
CHECKED BY DM	DATE May 99		APPROVED BY <i>David M.</i>	DATE 06-01-99
COST/SCHED-AREA			APPROVED BY	DATE
SCALE As Shown			DRAWING NO. Figure 2-6	REV. 0

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During a site reconnaissance for the RI in March 1989 the results of the dye test were discussed, and it was concluded that no tank existed at this site. When the area was investigated, a concrete manhole like cover was removed and an unlined limestone-filled pit was found. When the investigation was completed, the pit was not backfilled, but the manhole was covered with soil. The top of the limestone in the pit was observed to be within approximately 2 feet of the surface. Use of the pit ceased around 1985.

Analysis of aerial photographs of NSWCDL indicates that a concrete building, a bunker, and open service yard areas, all of which were accessed by Caskey Road, were located in the present-day Battery Service Area as early as 1937. Evidence of what appeared to be a pit in the Battery Service Area was first noted in the 1952 imagery, and it remained apparent in the photography as late as 1977.

An RI/FS was completed in phases for Site 29. Sampling activities, consisting of soil sampling, surface water and sediment sampling, and the installation and sampling of groundwater monitoring wells were completed in 1994. Additional soil sampling was performed before and after the removal action that was completed in 1997. A draft final RI was prepared in 1995. An addendum RI/FS was prepared in 1999.

In 1997, a removal action was performed and is described in Section 2.11.2.

### **2.9.2 Enforcement Actions**

No enforcement actions have been taken at Site 29. The Navy has owned this property since 1918 and is identified as the responsible party. NSWCDL was added to the NPL in 1994.

### **2.9.3 Highlights of Community Participation**

In accordance with Section 113 and 117 of CERCLA, the Navy provided a public comment period from July 21, 1999 through August 19, 1999 for the proposed remedial action described in the Remedial Investigation/Feasibility Study and the Proposed Remedial Action Plan for Sites 19 and 29.

These documents were available to the public in the Administrative Record and information repositories maintained at the Smoot Memorial Library, King George, Virginia; the NSWCDL General Library, Dahlgren, Virginia; and the NSWCDL Public Record Room, Dahlgren, Virginia. Public notice was provided in The Freelance Star newspaper on July 19, 1999 and The Journal newspaper on July 14, 1999 and a public meeting was held in the King George Courthouse on July 28, 1999. No written comments were received during the comment period. Spoken comments and responses provided during the public meeting are presented in Appendix B.

Additional community involvement, including Restoration Advisory Board (RAB) activities, are highlighted in Section 3.1.

## **2.10 SCOPE AND ROLE OF RESPONSE ACTION FOR SITE 29**

Site 29 is one of many sites identified in the Federal Facility Agreement (FFA) for NSWCDL. In previous years, RODs have been issued for several other sites in accordance with the priorities established in the Site Management Plan (SMP). A removal was performed at Site 29 in 1997. This action follows the removal and provides closure for the site.

The selected remedy (no further action) fits the Navy strategy to reduce risks at all NSWCDL sites with minimal long-term care. Site 29 soils are clean and require no future monitoring, allowing the Navy to focus its resources on the remaining NSWCDL sites. Soils at Site 29 are acceptable under the residential use scenario. Groundwater sampling at Site 29 indicated levels of metals that exceeded Maximum Contaminant Levels (MCLs); however, upgradient monitoring revealed that concentrations of these metals entering the site were at the same level or higher. It was determined in the RI/FS that Site 29 was not likely contributing to these concentrations.

## **2.11 SUMMARY OF SITE 29 CHARACTERISTICS**

The RI/FS and removal action are summarized below.

### **2.11.1 1995 Remedial Investigation**

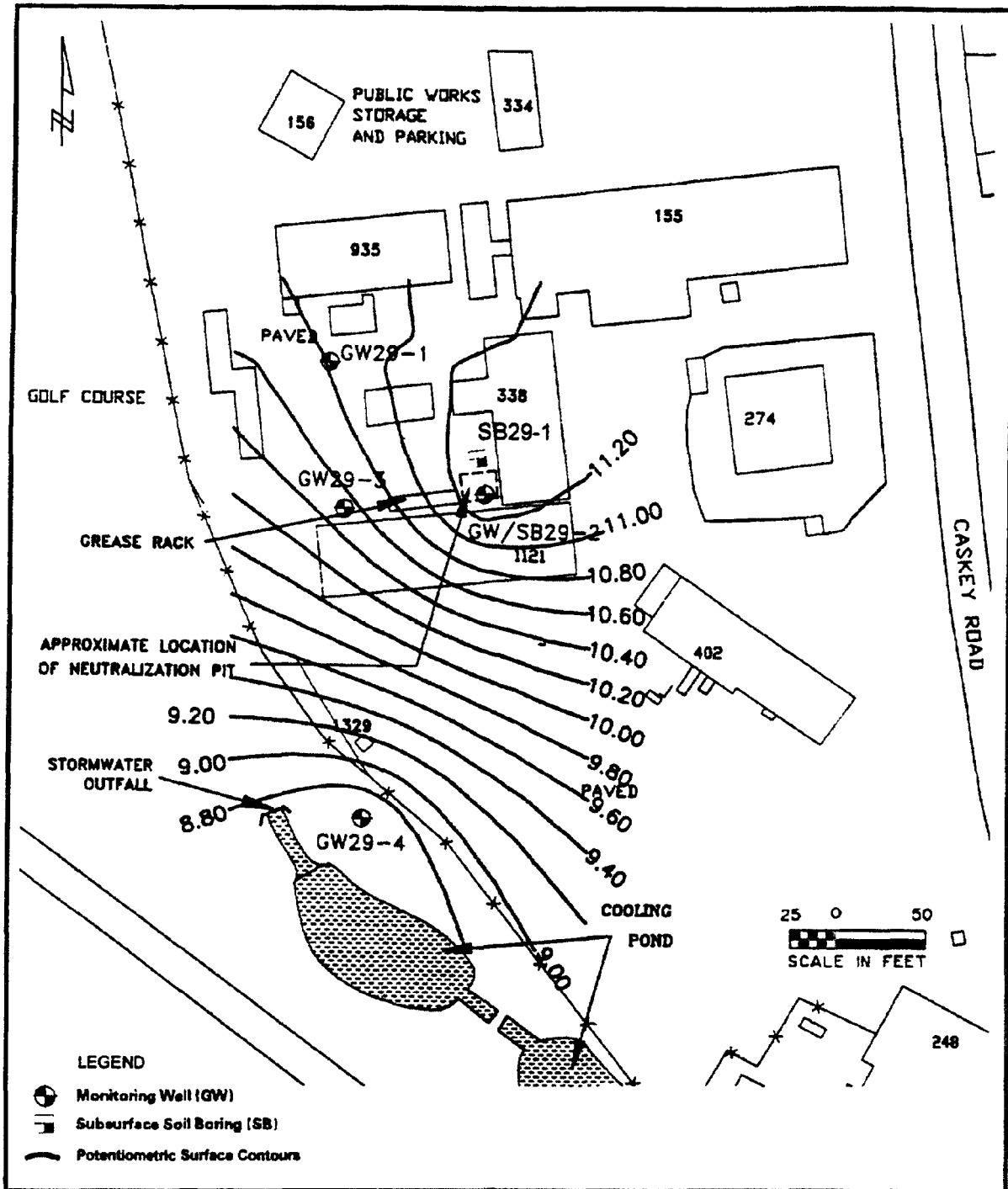
The RI at Site 29 included a hydrogeologic investigation, contaminant assessment, and risk assessment. The hydrogeologic investigation included the installation and sampling of one shallow groundwater monitoring well and the sampling of two existing shallow groundwater monitoring wells. Physical descriptions of the subsurface, a monitoring well elevation and location survey, groundwater-level measurements, and hydraulic conductivity testing were also included in the hydrogeologic investigation. Two soil borings, including one used for the completion of groundwater monitoring well GW29-2 (depth of 16 ft bgs), were completed in the immediate vicinity of the former pit. The subsurface in these borings consists predominantly of clayey sand (possible fill) to approximately 10 feet underlain by clay extending to the bottom of the borings (12 and 20 ft bgs). A defined saturated zone was not encountered in either of the two new borings. Predominant groundwater flow at the site is to the south-southwest (Figure 2-7). The estimated hydraulic conductivity in GW29-2 was  $4.9 \times 10^{-5}$  cm/sec.

The contamination assessment included the collection and analysis of samples from subsurface soil and groundwater. Eight subsurface soil samples were collected from two locations within the immediate vicinity of the pit (borings; SB29-1 and SB29-2, completed to 10 feet bgs). Groundwater samples were collected from the three wells. All samples were collected during the Phase 2 field investigation.

No organic compounds were detected in the groundwater samples at concentrations that exceeded either the MCLs or the Region III Risk-Based Concentration (RBC) screening values for tap water. Arsenic, beryllium, lead, nickel, and zinc were detected in the unfiltered groundwater samples at this site at maximum concentrations that exceeded either the MCLs and/or the Region III criteria; therefore, the untreated groundwater at this site may be considered to be unsuitable for potable use.

### **2.11.2 Removal Action**

A removal action was completed at Site 29 in 1997 and consisted of removal and disposal of the metals contaminated soil. (The neutralization pit had been removed during a 1996 RI sampling effort.) Soils contaminated with metals (antimony, arsenic, iron, lead, and mercury) and petroleum hydrocarbons were excavated and transported to the King & Queen Landfill located in Little Plymouth, Virginia for disposal. Target clean-up levels were based on USEPA Risk-Based Concentrations (RBCs) for metals and the VADEQ action level for Total Petroleum Hydrocarbon (TPH). Approximately 200 cubic yards of contaminated soil were removed. The entire excavation was approximately 21.5 ft. by 38 ft. by 7 ft. deep. Soil sampling and analyses were conducted from the sides and bottom of the excavation to confirm that all soil with concentrations greater than or equal to target clean-up levels was removed. Except for arsenic, target clean-up concentrations were achieved at Site 29. Arsenic concentrations of 6.87, 7.62, and 7.64 (mg/kg) were detected at three sample locations. The excavation was then backfilled and covered with asphalt pavement.



DRAWN BY TF	DATE May 99	Tetra Tech NUS, Inc.  Potentiometric Surface Map Site 28  NSWCDL Dahlgren, Virginia	CONTRACT NO. 7188-1801	OWNER NO. CTO 261
CHECKED BY DM	DATE May 99		APPROVED BY 	DATE 06-01-99
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### **2.11.3 1999 Remedial Investigation/Feasibility Study**

Follow-up remedial investigation activities consisting of a human health and ecological risk analysis was performed to determine whether further action was required. These results are summarized below.

#### **2.11.3.1 Sources of Contamination**

Extensive soil sampling was conducted to identify the extent of contamination near the neutralization pit. The only known waste to have been disposed of at Site 29 is battery acid, which was discharged to an unlined neutralization pit through a concrete manhole cover. Acid disposal into the pit ceased around 1985, at which time the pit was not backfilled. The neutralization pit was removed in 1996. The contaminated soil was removed in 1997 as part of the removal action.

#### **2.11.3.2 Description of Contamination**

Soil and groundwater sampling was conducted under the RI because of the reported discharge of liquid battery acid into an unlined neutralization pit. Initial data needs included the inspection, evaluation, and rehabilitation of the existing monitoring wells originally installed in the vicinity of Site 29 as part of UIST studies. These field activities were completed in June 1993 as part of the Phase 1 field activities under the RI. Phase 2 activities included the collection of soil samples, the installation of an additional groundwater monitoring well, and the collection of groundwater samples from new and existing monitoring wells.

Two main objectives were identified for the RI at Site 29. Subsurface samples were collected to determine the presence or absence of residual contamination in the pit and surrounding soils. In addition, groundwater samples were collected to determine the presence or absence of contaminants in the shallow aquifer resulting from potential migration of wastes from the pit. Depth and direction of groundwater flow were also determined as part of the Phase 2 Investigation.

The analytical parameters selected for soil and groundwater samples from Site 29 included volatile and semivolatile organic compounds, metals, cyanide, TPHs, and sulfate. Groundwater samples were also analyzed for hardness. The identified parameters were selected as representative constituents likely to be present because of the types of wastes disposed in the area. Volatile and semivolatile compounds, metals, and cyanide were included because these constituents may be present from operations at the adjacent grease rack. TPH was included because of operations at the grease rack and the former USTs in the area. Sulfate analysis was included based on disposal of sulfuric acid in the pit. Lead was a concern because it may have been dissolved in the battery acid. Determination of pH in groundwater samples provided a simple analytical tool for indicating the presence of residual acidity.

Soil samples collected during the 1995 RI indicated metals contaminated soils in the vicinity of the neutralization pit. (Soil in these sample areas was excavated and transported offsite for disposal during the 1997 removal action.) In addition, groundwater samples, shown in Figure 2-7, were collected as part of the 1995 RI. Post removal verification soil samples, shown in Figure 2-8, were collected from the side walls and bottom of the excavation area after the removal action was completed in 1997. Table 2-4 lists the chemicals of potential concern for each medium and the maximum concentration detected. The results of the sampling and analyses are presented below.

#### **Subsurface Soils**

Benzo(a)pyrene, arsenic, and chromium were detected in subsurface soils as shown in Table 2-4. Benzo(a)pyrene was detected in one of the five samples at a concentration of 160 µg/kg, above the residential Risk-Based Concentrations (RBC) screening level of 87µg/kg. The arsenic concentrations

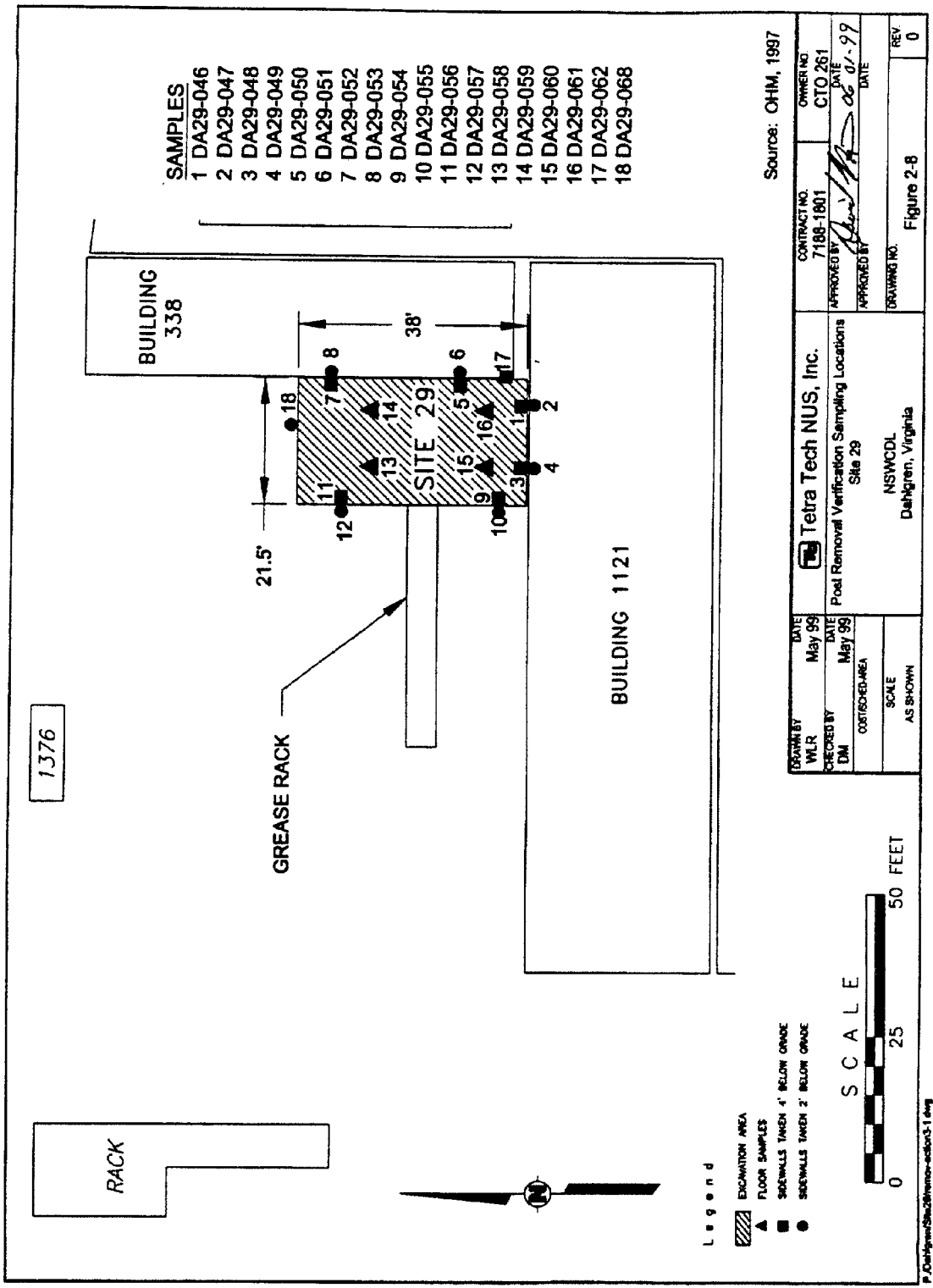


TABLE 2-4

**MAXIMUM DETECTED CONCENTRATIONS FOR COPCs (POST REMOVAL)**  
**SITE 29: BATTERY SERVICE AREA**  
**NSWCDL, DAHLGREN, VIRGINIA**

<b>SUBSURFACE SOILS</b>	
<b>Organics (mg/kg)</b>	
Benzo(a)pyrene	0.16
<b>Metals (mg/kg)</b>	
Arsenic	7.64
Chromium	37.7
<b>GROUNDWATER</b>	
<b>Organics (mg/L)</b>	
Benzene	0.001
<b>Metals (mg/L)</b>	
Aluminum	9.71
Arsenic	0.0064
Iron	23.2
Lead	0.113
Manganese	2.62
Nickel	0.0749
Zinc	1.57

marginally exceeded background. The maximum and average site concentrations were 7.64 mg/kg and 4.2 mg/kg, respectively. The maximum background concentration of arsenic was 3.3 mg/kg. Chromium was detected at a maximum concentration of 37.7 mg/kg, above the residential RBC screening level of 23 mg/kg. The maximum background concentration of chromium is 18.5 mg/kg.

## **Groundwater**

Benzene, aluminum, arsenic, copper, iron, lead, manganese, nickel, and zinc were detected in groundwater and maximum concentrations are presented on Table 2-4.

## **Surface Water and Sediment**

Surface water and sediment samples were collected from the Cooling Pond (Site 55) in support of the RI for Site 55. These results will be addressed in the Site 55 RI.

### **2.11.3.2.1 Contaminant Migration**

The predominant COPCs were metals. Before the removal action, several metals detected in subsurface soils in the vicinity of the former pit area exceeded metal concentrations in background soil samples. These constituents are believed to have been the result of past practices in the neutralization pit. Groundwater transport was the only potential migration pathway for these constituents because the contaminated soils were covered by asphalt pavement. COPCs identified in groundwater included aluminum, arsenic, copper, iron, lead, manganese, nickel, and zinc.

Subsurface soils of the saturated zone at Site 29 vary between clay with fine sand to silty clay. Inorganic constituents exhibit low mobility in clay and silty clay soils. The ability of soils to absorb inorganic constituents increases with an increase in surface area and clay content of soil grains. The mobility of zinc may vary between low to moderate in sandy clay and clay soils. The mobility of copper is expected to be low in clay and sandy clay soils. In addition, the hydraulic conductivity of the saturated soils at Site 29 was estimated to be  $1.0 \times 10^{-5}$  cm/sec indicating low groundwater velocities.

If sufficient acid waste is added to depress the soil pH to less than five, then soils generally lose their ability to retain metals. More acidic soil conditions could therefore result in increased mobility of inorganic constituents in soil. The pH of the subsurface soils and groundwater at Site 29 varied between five and six. These pH levels are similar to values detected at the other IR sites at NSWCDL. Therefore, disposal activities at Site 29 do not appear to have significantly altered pH levels in soil and groundwater.

Based on the soil characteristics, the potential for mobility of inorganic constituents at Site 29 appears to be low. Considering the retardation of contaminants in clay soils and low groundwater velocity, mobilization and transport of inorganic constituents could be occurring at a slow rate at Site 29.

Groundwater at Site 29 appears to be discharging into the Cooling Pond located downgradient of monitoring well GW 29-4 (see Figure 2-7). The potential for the migration of inorganic constituents to the Cooling Pond (from the former neutralization pit) was evaluated using a fate and transport model. Potential transport to surface water and sediment in the Cooling Pond was evaluated for groundwater COPCs identified in the ecological risk assessment (aluminum, copper, lead, manganese, and zinc). Transport of these constituents from subsurface soil to groundwater to the Cooling Pond was assessed using the residual soil concentrations and existing groundwater concentrations. Surface water dilution was based on runoff from the area draining into the upper leg of the Cooling Pond and a precipitation rate of 40 in/yr. The groundwater discharge face was assumed to be the entire length along the upper leg of the Cooling Pond (600-ft). No dispersion from the source area to the discharge point was conservatively assumed. Based on the evaluation, groundwater concentrations are not expected to negatively impact surface waters or sediments in the Cooling Pond.



## **2.12 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES**

Site 29 is located in the south-central portion of the Mainside in the public work area. The site is located behind Buildings 338 and 1121 and can be accessed via the road servicing these buildings. Buildings to the north, south, and east, and a chain-link fence to the west border the site.

The site is paved, which limits the possibility of contact with contaminated materials. Immediately west of the fence is the base golf course. Land within a 0.5 mile radius of the Battery Service Area is mainly developed for residential and base support activities. Public works and operations areas of the base lie to the north, south, and east of the site. Residences are located within 1,000 feet of the site. Roads adjacent to the site are used by base personnel for jogging and bike riding. In addition, fishing is allowed in the Cooling Ponds on a catch and release basis. A golf course is located just south of the site in the residential area. The buildings surrounding Site 29 are regularly occupied by base personnel. However, no significant activity happens outside the buildings. Access to the site is restricted on three sides because of the presence of buildings. However, the west side allows unrestricted access from within the inner security perimeter. Site 29 is currently an industrial use area and is anticipated to remain an industrial use area in the future. The mission of the base is currently expanding and future potential for base closure and conversion to residential land use is considered to be minimal.

The watertable (or Columbia) aquifer beneath Site 29 is a thin water bearing zone underlain by a laterally persistent clay confining layer (or Upper Confining Unit). Shallow groundwater at the Base is known to discharge to adjacent shallow water bodies, in this case the manmade Cooling Pond located approximately 250 ft. from Site 29. The watertable aquifer at the Base is generally of poor quality because of high, naturally occurring concentrations of some metals (i.e. iron and manganese) according to a United States Geological Survey (USGS) study of basewide groundwater quality. Poor water quality, coupled with the thin saturated thickness and locally high percentages of fine grain sediments, effectively diminishes the feasibility of using the watertable aquifer as an industrial or potable water source. However, in the risk evaluation for Site 29, the watertable aquifer is considered to be a potential source of potable water.

## **2.13 SUMMARY OF SITE 29 RISKS**

The ecological and human health risks associated with exposure to contaminated media at Site 29 were evaluated in the Addendum RI/FS Report. The residential use scenario was evaluated for completeness; although the site is anticipated to remain in industrial use.

### **2.13.1 Environmental Evaluation**

During the 1995 RI, an Ecological Risk Assessment was conducted. It concluded that shallow groundwater associated with Site 29 flows toward the Cooling Pond (located nearby and to the south of the Battery Service Area) and likely discharges into the pond. This is the primary mechanism for transport of contaminants from the Battery Service Area because the surface soils in the vicinity of the Battery Service Area are paved over and not exposed. Ecological receptors inhabiting or using the Cooling Pond may come in contact with potential contaminants entering the pond via groundwater discharges associated with Site 29. Aluminum, lead, manganese, and zinc were identified as COPCs in groundwater. To investigate these exposure pathways, samples of groundwater and subsurface soils were collected from the site, which are summarized in Table 2-4. Based on current conditions at Site 29 and fate and transport modeling of groundwater constituents, it is unlikely that ecological receptors will come in contact with any contaminants present in these two media; therefore, risks to ecological receptors are believed to be minimal, requiring no further action.

### **2.13.2 Human Health Risks**

#### **Exposure Pathways and Potential Receptors**

Base workers, construction workers, and onsite residents (children and adults) were evaluated as potential receptors in the quantitative risk assessment. Base workers were considered for current and future conditions. Construction workers and onsite residents were evaluated for future conditions only. Although the potential for the base to be converted to residential land use is minimal, potential risks to future onsite residents were quantified for purposes of completeness. Under the current and future land use scenarios considered at Site 29, the exposure routes were incidental ingestion of soil and dermal contact with soil.

The potential groundwater exposure route was considered for hypothetical future residents. These residents were assumed to be exposed by ingestion of groundwater, dermal contact with groundwater, and inhalation of volatiles emitted from water while showering. The potential inhalation of volatiles and dust from soil was not considered because the site is relatively flat, and covered with asphalt or buildings. Volatile organics are not COPCs at Site 29, and dust emissions would be minimal under current land use conditions. It is assumed that good construction practices and moist soil at Site 29 (resulting from the shallow water table) will minimize emissions of dust.

#### **Exposure Assessment**

The COPCs that were evaluated and their maximum exposure point concentrations are presented in Table 2-5. Exposure point concentrations are used to determine potential human health risks.

#### **Toxicity Assessment**

The toxicity assessment characterizes the nature and magnitude of potential health effects associated with human exposure to COPCs at a site. Quantitative risk estimates for each COPC and exposure pathways are developed by integrating chemical-specific toxicity factors with estimated chemical intakes discussed in the previous section.

Quantitative risk estimates are calculated using cancer slope factors (CSFs) for COPCs exhibiting carcinogenic effects and reference doses (RfDs) for COPCs exhibiting systemic (noncarcinogenic) effects. A summary of the RfDs and CSFs used in the baseline human health risk assessment is presented in Table 2-6.

CSFs and RfDs developed by USEPA are based on ingestion (oral) or inhalation routes of exposure rather than dermal contact. Therefore, these values reflect administered doses rather than absorbed doses. USEPA guidance on assessment of dermal exposure (USEPA, 1992b) recommends that oral toxicity factors used in dermal risk assessment be adjusted for gastrointestinal absorption efficiency, if such data are available. The dermal RfDs and CSFs adjusted for gastrointestinal absorption are listed in Table 2-6. The dermal toxicity criteria are derived per the methodology presented in Appendix A of the Risk Assessment Guidance for Superfund, Part A (USEPA, 1989). According to USEPA Region III policy, the dermal contact exposure pathways is not evaluated quantitatively for PAHs. Therefore, potential risks from dermal contact exposure to benzo(a)pyrene in soil are not quantified in this risk assessment.

**TABLE 2-5**  
**CHEMICALS OF POTENTIAL CONCERN AND EXPOSURE POINT CONCENTRATIONS<sup>(1)</sup>**  
**SITE 29, BATTERY SERVICE AREA**  
**NSWCDL, DAHLGREN, VIRGINIA**

	Organics		Inorganics	
	Chemical	Exposure Point Concentration <sup>(1)</sup> (mg/kg)	Chemical	Exposure Point Concentration <sup>(1)</sup> (mg/kg)
<b>Subsurface Soil (mg/kg)</b>				
Construction Worker, Base Worker, and Future Hypothetical residential Scenarios	Benzo(a)pyrene	0.16	Arsenic Chromium	7.64 37.7
<b>Groundwater (mg/L)</b>				
Future Hypothetical Residential Scenario	Benzene	0.001	Aluminum	9.71 (4.47) <sup>(2)</sup>
			Arsenic	0.0064 (0.0029) <sup>(2)</sup>
			Iron	23.2 (10.7) <sup>(2)</sup>
			Lead	0.113 (ND) <sup>(2)</sup>
			Manganese	2.62 (2.62) <sup>(2)</sup>
			Nickel	0.0749 0.0734 <sup>(2)</sup>
			Zinc	1.57 (0.556) <sup>(2)</sup>

1 Maximum concentrations are used as exposure point concentrations for RME and CTE in soil and groundwater because the post-removal soil and field investigation groundwater database contain less than 10 samples.

2 Values in parentheses are maximum concentrations from filtered samples.

ND = Not Detected

TABLE 2-6

**DOSE-RESPONSE PARAMETERS  
SITE 29: BATTERY SERVICE AREA  
NSWCDL, DAHLGREN, VIRGINIA**

Chemical	RfD Oral <sup>(1)</sup> (mg/kg-day)	Rfd Inhalation <sup>(1)</sup> (mg/kg-day)	CSF Oral <sup>(1)</sup> (kg-day/kg)	CSF Inhalation <sup>(1)</sup> (kg-day/mg)	Gastrointestinal Absorption factor	RfD Dermal (mg/kg-day)	CSF Dermal (kg-day/mg)	Weight of Evidence
Benzene	3E-3 <sup>(3)</sup>	1.7E-3 <sup>(3)</sup>	2.9E-2	2.9E-2	NA <sup>(2)</sup>	3E-3	NA <sup>(2)</sup>	B2
Benzo(a)pyrene	NA <sup>(2)</sup>	NA <sup>(2)</sup>	7.3E+0	3.1E+0	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	B2
Aluminum	1E+0 <sup>(3)</sup>	1E-3 <sup>(3)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	0.05	5E-2	NA <sup>(2)</sup>	NA <sup>(2)</sup>
Arsenic	3E-4	NA <sup>(2)</sup>	1.5E+0	1.51E+1	0.95 <sup>(5)</sup>	2.85E-4	1.58E+0	A-Inhalation
Chromium VI (hexavalent)	3E-3	3E-5	NA <sup>(2)</sup>	4.1E+1 <sup>(4)</sup>	0.01 <sup>(6)</sup>	3E-5	NA <sup>(2)</sup>	A
Iron	3E-1 <sup>(3)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	3E-1	NA <sup>(2)</sup>	NA <sup>(2)</sup>
Lead	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	B2
Manganese - water	2E-2 <sup>(7)</sup>	1.43E-5	NA <sup>(2)</sup>	NA <sup>(2)</sup>	0.03 <sup>(8)</sup>	6E-4	NA <sup>(2)</sup>	D
Nickel	2E-2	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	0.04 <sup>(9)</sup>	8E-4	NA <sup>(2)</sup>	D
Zinc	3E-1	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	0.5 <sup>(10)</sup>	1.5E-1	NA <sup>(2)</sup>	D

1 USEPA, 1999a (IRIS), unless otherwise noted.

2 NA - Not available/applicable.

3 USEPA-NCEA provisional value, 1998a

4 HEAST, 1997b.

5 ATSDR, 1991.

6 ATSDR, 1993.

7 USEPA, 1996c. Value reflects a modifying factor of 3 that is considered appropriate for drinking water exposures. Based on a study of humans who had ingested drinking water containing elevated levels of manganese as well as on assumptions regarding differences in absorption of manganese in food as opposed to water.

8 USEPA, 1984

9 ATSDR, 1993

10 Elinder, 1986

USEPA's Weight of Evidence Classifications:

A1 known human carcinogen.

B1 Probable human carcinogen; limited human data are available.

B2 Probable human carcinogen; sufficient evidence in animals and inadequate or no evidence in humans.

C Possible human carcinogen.

D Not classifiable as to human carcinogenicity.

## Chromium Toxicity

Chromium was identified as a COPC in subsurface soil at Site 29. Analytical results for this chemical are reported as total chromium. Chromium may be present in different oxidation states. The hexavalent state, which is a less common state of chromium in environmental mixtures, is the most toxic form of chromium. No speciation analyses were performed to distinguish among the specific chromium oxidation states present at the site. For purposes of risk assessment, it is assumed conservatively that chromium is present in the hexavalent state.

## Lead Toxicity

The equations and methodology used to evaluate other COPCs cannot be used to evaluate exposure to lead because of the absence of published dose-response parameters for this constituent. Lead was identified as a COPC for groundwater because the maximum detected concentration of lead, 113 µg/L in sample GW-29-2(94), exceeded the 15 µg/L Federal Safe Drinking Water Act (SDWA) Action Level (USEPA, October 1996b).

Exposure to lead in water is typically addressed using the USEPA Integrated Exposure Uptake Biokinetic (IEUBK) Model for lead (USEPA, 1994a) for exposure to small children. This model evaluates exposure to lead in water and/or soil and is designed to estimate blood lead levels based on either default or site-specific input values. The evaluation of lead is discussed below.

The toxicity profiles for the COPCs are presented in Appendix C.

## Risk Characterization

Excess lifetime cancer risks are determined by multiplying the intake level and the cancer slope factor. These risks are probabilities that are generally expressed in scientific notation (e.g.,  $1 \times 10^{-6}$ ). An excess lifetime cancer risk of  $1 \times 10^{-6}$  indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime, under the specific exposure conditions at a site.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium (i.e., water, air, or soil) is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's RfD). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the HI can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

**Base Worker.** The cumulative noncancer HIs for ingestion of and dermal contact with soils for Site 29 under industrial land use conditions are less than one, which indicates that no significant hazards are associated with soils at Site 29.

The cumulative ingestion and dermal contact cancer risk is  $2.8 \times 10^{-6}$ , under a RME scenario. Although the incremental cancer risk for the base worker slightly exceeded  $1 \times 10^{-6}$ , it is within USEPA's target risk range of  $1 \times 10^{-4}$  to  $1 \times 10^{-6}$ .

**Construction Worker.** The cumulative noncancer HIs for ingestion of and dermal contact with soils for Site 29 under industrial land use conditions are less than one, which indicates that no significant hazards are associated with soils at Site 29.

The cumulative ingestion and dermal contact cancer risk is  $6.3 \times 10^{-7}$ , under a RME scenario, which is less than USEPA's target risk range of  $1 \times 10^{-4}$  to  $1 \times 10^{-6}$ .

**Future Resident.** The cumulative noncancer HIs for ingestion of and dermal contact with soils for Site 29 under hypothetical residential land use conditions are less than one, which indicates that no significant hazards are associated with soils at Site 29.

The total residential incremental lifetime cancer risk based on cumulative ingestion and dermal contact with soils is  $7.8 \times 10^{-6}$ , under a RME scenario, which is within USEPA's target risk range of  $1 \times 10^{-4}$  to  $1 \times 10^{-6}$ .

The cumulative noncancer HIs for exposure to groundwater for Site 29 under hypothetical residential land use conditions are 16.5 for the RME. The HI for the RME exceeds one primarily as a result of the ingestion of aluminum, arsenic, iron, and manganese in groundwater. The RfDs for aluminum and iron are not based on any health effects but rather on recommended daily allowances for human nutrition. Therefore, the risks for aluminum and iron are overstated. USEPA's risk assessment guidance allows the Navy and USEPA to discount risk based on exceeding recommended maximum daily allowances for nutrition. Additionally, evidence suggests that the arsenic, manganese and iron occur naturally in the ground water at Site 29. The Superfund law forbids the Navy and USEPA from taking remedial action in response to the release of "a naturally occurring substance in its unaltered form, or altered solely through naturally occurring processes or phenomena, from a location where it is naturally found." 42 U.S.C. § 9604(a)(3). Accordingly, USEPA's risk assessment guidance permits EPA to discount risks that are caused by naturally occurring conditions. A significant portion of the HI for ground water is due to iron, manganese and arsenic. Background samples of ground water at NWSDL--i.e., ground water samples designed to measure naturally occurring concentrations of substances--show that arsenic occurs naturally in filtered ground water at concentrations ranging from 0-8 parts per billion (ppb), with average background concentrations of 2-4 ppb. Arsenic was detected at 2.9 ppb in filtered ground water samples taken from site 29, which is within the average background concentration range. Thus, it appears that arsenic in ground water is due to conditions that occur naturally at NWSDL. Iron and manganese concentrations are also within the range of background and appear to be naturally occurring conditions. In these circumstances, USEPA and the Navy are permitted to discount risk due to iron, manganese and arsenic in ground water. If aluminum, arsenic, iron, and manganese are eliminated as COPCs, the HI calculated for the hypothetical resident is less than one. A HI of less than one indicates that there are no significant hazards.

According to the risk assessment, a person who lived at the site for their entire life would face an increased risk, equivalent to 14 chances in 100,000 ( $1.4 \times 10^{-4}$ ), of developing cancer because she drank unfiltered ground water. This risk is very slightly above the upper boundary of USEPA's acceptable risk range,  $1 \times 10^{-4}$ . USEPA risk assessment guidance, however, states that "The upper boundary of the risk range is not a discrete line at  $1 \times 10^{-4}$  .... A specific risk estimate around  $10^{-4}$  may be considered acceptable if justified based on site-specific conditions." *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions* at pg. 2, EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-30 (April 22, 1991).

After considering the circumstances of Site 29, the Navy, USEPA and VADEQ have concluded that the incremental cancer risk associated with drinking ground water is within acceptable limits. There are at least two reasons for this conclusion. First, the element arsenic is by far the greatest contributor to the incremental cancer risk associated with drinking ground water at Site 29. As noted above, however, evidence suggests that the arsenic concentrations in ground water at Site 29 are due to naturally occurring conditions. In these circumstances, USEPA and the Navy are permitted to discount risk due to arsenic in ground water. When this is done, the incremental cancer risk attributable to drinking ground water at Site 29 is within acceptable limits.

Second, the  $1.4 \times 10^{-4}$  figure is based on the assumption that an adult resident would drink unfiltered ground water for a lifetime. This is unlikely due to the naturally poor quality of groundwater, and some filtration would be necessary. The calculated incremental cancer risk for filtered water at Site 29 is  $8.8 \times 10^{-5}$ , which is within USEPA's acceptable risk range.

Exposure to lead in groundwater (and soil) was evaluated using unfiltered groundwater concentrations and maximum soil concentrations, respectively. Because of the absence of published dose-response parameters for lead, the exposure and potential risks associated with lead are addressed through the use of the USEPA Integrated Exposure Uptake Biokinetic (IEUBK) Model for the child 0-7years old. Based on this model, the calculated risk was just equal to the established level of “concern” (10 ug/dL). However, risk due to lead is overstated based on the following factors:

- Maximum lead soil and groundwater concentrations were used in the IEUBK Model rather than average concentrations. If average concentrations were used, the blood lead level would be significantly lower.
- Unfiltered metals concentrations were evaluated in the risk assessment. Lead was not detected in filtered samples collected during the field investigation, indicating turbidity (suspended particulates) is influencing the metal concentrations reported for the unfiltered samples. An analysis based on filtered samples would not include lead in groundwater and the risk would be correspondingly reduced.

### Uncertainty Analysis

The following sources of uncertainty are specific to post-remedial conditions at Site 29:

- Because less than 10 subsurface soil and groundwater samples are available in the post-removal data sets for Site 29, the maximum reported concentrations were used as the exposure point concentrations. The total risk estimates may be overestimated as a result of the evaluation of maximum concentrations for all COPCs.
- The arsenic concentrations in groundwater reflect background (or upgradient) conditions (i.e., upgradient and downgradient concentrations are similar). If arsenic was eliminated as a COPC for groundwater, then the total carcinogenic risk estimate for the hypothetical future resident exposed to soils and groundwater would fall within USEPA's target risk range.
- The RfDs for iron and aluminum are not based on any health effects but rather on recommended daily allowances for human nutrition. Consequently, some USEPA regions (e.g., USEPA Region I) suggest that quantitative risk assessments not be performed for aluminum and iron. If these constituents are eliminated as COPCs for groundwater, the HI for the hypothetical future child and adult residents would be substantially reduced.

### Summary and Conclusions

The following items summarize the results of a human health risk assessment conducted based on the post-removal action soil and groundwater databases for Site 29:

1. HIs calculated for base workers who are exposed to soil do not exceed one indicating that adverse health effects are not anticipated under the conditions established in the exposure assessment. Cancer risk estimates developed for this receptor are  $2.8 \times 10^{-6}$  and  $5.0 \times 10^{-7}$  for the RME and Central Tendency Exposure (CTE) case, respectively. Arsenic is the primary risk driver. However, arsenic concentrations appear to only marginally exceed background. The arsenic concentrations in the Site 29 soils range from 2.38 mg/kg to 7.64 mg/kg (average concentration was 4.2 mg/kg). The maximum arsenic concentration in the background soil data set was 3.3 mg/kg.

2. HIs calculated for the construction worker exposed to subsurface soil are less than one. Consequently, adverse noncarcinogenic health effects are not anticipated for this receptor. Cancer risk estimates for the construction worker do not exceed  $1 \times 10^{-6}$ .
3. A hypothetical future resident was evaluated for purposes of completeness. The HIs calculated assuming exposure to subsurface soil are less than one. The cancer risk estimates developed assuming exposure to soils for the RME and CTE cases ( $2.2 \times 10^{-5}$  and  $2.2 \times 10^{-6}$ , respectively) are within USEPA's target risk range of  $1 \times 10^{-4}$  to  $1 \times 10^{-6}$ . The primary risk driver is arsenic. However, arsenic concentrations in the Site 29 soils are marginally greater than background.
4. HIs were also developed for a hypothetical future resident using the groundwater as a domestic water supply. The HI for the RME resident exposed to COPCs in groundwater was 16.5. The primary risk drivers were aluminum, arsenic, manganese, and iron. However, concentrations of arsenic, iron, and manganese appear to be naturally occurring. The RfDs for aluminum and iron are not based on any health effects but rather on recommended daily allowances for human nutrition. The manganese concentration reported for the monitoring well located at the source area is less than the RBC for tap water and is less than the concentration reported for a well located downgradient of the source area. If aluminum, arsenic, iron, and manganese are eliminated as COPCs, the HI calculated for the hypothetical resident using the groundwater is less than 1.0. A HI less than 1.0 indicates that there are no significant hazards.
5. Cancer risk estimates developed for the hypothetical future resident using groundwater were  $1.4 \times 10^{-4}$  for the RME. However, arsenic, the major carcinogenic COPC in groundwater, was detected at concentrations that appear to be naturally occurring.
6. The COPC concentrations reported for the Site 29 monitoring wells do not exceed current Federal Safe Drinking Water Act (SDWA) primary (health-based) MCLs. Secondary (aesthetic-based) standards for aluminum, iron, and manganese are exceeded. Additionally, the maximum lead concentration in an unfiltered groundwater sample exceeds the current SDWA Action Level for lead in drinking water. However, lead concentrations in filtered groundwater samples do not exceed the current SDWA Action Level for lead in drinking water, suggesting that turbidity is influencing lead concentrations in the unfiltered sample. Lead concentrations reported for the unfiltered sample collected from the upgradient monitoring well also exceed the SDWA Action Level. Lead is not a pervasive contaminant in soils at Site 29.

The cancer risk estimates for the human receptors evaluated are within or less than USEPA's target risk range of  $1 \times 10^{-6}$  to  $1 \times 10^{-6}$  and reflect in part, background or naturally occurring conditions for the site. The HIs calculated for receptor exposure to soil are less than one indicating that adverse noncarcinogenic health effects are not anticipated. The analytical results do indicate that the groundwater quality in the vicinity of the site may not be suitable for domestic purposes. For the metals that drive the risk estimates, the pattern of contamination and the aforementioned studies regarding manganese suggest that Site 29 is not the source of these metal concentrations. Consequently, site-specific actions may be ineffective in improving water quality or protecting future potential users.



## **SOILS**

The Draft Final RI for Site 29 indicated metals concentrations in soil were the only contaminant that warranted remedial action. Subsequently, the neutralization pit and adjacent soils were excavated and disposed of offsite. Sampling data was collected to verify the removal action had achieved its objectives. This data was re-evaluated in a revised risk assessment. The revised risk assessment for soil indicated remaining risks are acceptable. It is recommended that no further action be taken for soils at Site 29.

## **GROUNDWATER**

The risk assessment for groundwater indicates risks are acceptable even though they are at the upper end of the acceptable limit. Site 29 is not the source of the metals that are driving the risk. It is recommended that no further action be taken for groundwater at Site 29 for the following reasons:

1. The pattern of groundwater contamination indicates that the Site 29 neutralization pit is not a source of the contaminants.
2. Arsenic concentrations in downgradient wells (filtered and unfiltered) were slightly less than concentrations detected in the upgradient well (filtered and unfiltered). Arsenic concentrations appear to be naturally occurring.
3. Iron concentrations in downgradient wells were similar to or less than concentrations detected in the upgradient well. Based on this, downgradient iron concentrations are not considered significantly different from background concentrations. Furthermore, the iron concentrations downgradient of Site 29 are considerably less than the maximum basewide concentration reported by the USGS.
4. Lead concentrations detected in the upgradient well and in GW29-2, which is located at the source area, exceeded the SDWA Action Level (15 µg/L) in unfiltered samples. However, lead was not detected in filtered groundwater samples from either well and results of the IEUBK Model suggest that no action is necessary to protect human health.
5. Manganese concentrations detected in GW29-2 (141 µg/l), which is located at the source area, were less than the upgradient concentration (272 µg/l). It should be noted the downgradient concentration (2,600 µg/l) were higher than the site-specific background concentration. However, all Site 29 manganese values are well below the maximum basewide concentration reported by USGS (7,000 µg/l).

The pattern of metals detected in shallow groundwater at Site 29 indicates the metals concentrations are attributable to naturally occurring conditions and not attributable to Site 29. Based on this, the selected remedy for Site 29 is no further action.

### **2.14 DOCUMENTATION OF SIGNIFICANT CHANGES**

The selected remedy is the same alternative identified as the recommended alternative in the Proposed Remedial Action Plan and that was presented to the public at the public meeting held July 28, 1999.

There were no significant changes to the recommended remedial action alternative in the Proposed Plan.

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### 3.0 RESPONSIVENESS SUMMARY

No written comments, concerns, or questions were received by the Navy, USEPA, or the Commonwealth of Virginia during the public comment period from July 21, 1999 to August 19, 1999. A public meeting was held on July 28, 1999 to present the Proposed Plan for Site 19 and Site 29 soils and groundwater and to answer any questions on the Proposed Plan and on the documents in the information repositories. A 30 minute presentation was provided during which informal questions were addressed.

A summary of the questions (and responses) that were asked at the public meeting is provided in Appendix B.

#### 3.1 BACKGROUND ON COMMUNITY INVOLVEMENT

The Navy and NSWCDL have had a comprehensive public involvement program for several years. Starting in 1993, a Technical Review Committee (TRC) met, on average, twice a year to discuss issues related to investigative activities at NSWCDL. The TRC was composed of mostly governmental personnel; however, a few private citizens attended the meetings.

In early 1996 the Navy converted the TRC into a Restoration Advisory Board (RAB) and eight to ten community representatives joined. The RAB is co-chaired by a community member and has held meetings approximately every 4 to 6 months. The RI/FS and the Proposed Plan for Site 19 soils and Site 29 soils and groundwater were both discussed at the RAB meetings.

Community relations activities for the final selected remedy include:

- The documents concerning the investigation and analysis at Site 19 and 29, as well as a copy of the Proposed Plan, were placed in the information repository at the NSWCDL General Library and the Smoot Memorial Library.
- Newspaper announcements on the availability of the documents and the public comment period/meeting date was placed in *The Journal* on July 14, 1999 and the *Freelance Star* newspaper on July 19, 1999.
- The Navy established a 30-day public comment period starting July 21, 1999 and ending August 19, 1999 to present the Proposed Remedial Action Plan. No written comments were received during the 30-day public comment period.
- A Public Meeting was held July 28, 1999 to answer any questions concerning the Site 19 and 29 Proposed Plan. Approximately 10 people, including Federal, state, and local government representatives attended the meeting.

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**APPENDIX A**  
**VIRGINIA CONCURRENCE LETTER**



# **COMMONWEALTH of VIRGINIA**

## **DEPARTMENT OF ENVIRONMENTAL QUALITY**

James Gilmore III  
Governor

Dennis H. Tracey  
Director

**John Paul Woodley, Jr.**  
Secretary of Natural Resources

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**1-800-592-5482**

September 23, 1999

Mr. Abraham Ferdas, Division Director  
Hazardous Site Cleanup Division (3HS00)  
U.S. Environmental Protection Agency, Region III  
1650 Arch Street  
Philadelphia, PA 19103-2029

Re: Record of Decision for Site 19 (Soil) and Site 29, NSWC Dahlgren, Virginia

Dear Mr. Ferdas:

The Virginia Department of Environmental Quality staff has reviewed the Record of Decision ("ROD") for Site 19 - Transformer Draining Area (Soils), and Site 29 -- Battery Service Area (Soils and Groundwater), at the Naval Surface Warfare Center, Dahlgren, Virginia. On behalf of the Commonwealth of Virginia, we concur with the selected remedial alternatives as outlined in the ROD dated September 1999.

Should you have any questions concerning this letter, please feel free to contact Dave Gillispie at (804) 698-4209.

Very truly yours,

A handwritten signature in cursive script that reads "Erica S. Dameron".

**Erica S. Dameron**  
Director, Office of Remediation Programs

cc: Ryan Mayer, ChesDiv  
Ann Swope, NSWC Dahlgren  
Bruce Beach, EPA Region III  
Hassan Vakili, VDEQ  
Durwood Willis, VDEQ  
Dave Gillispie, VDEQ

**APPENDIX B**  
**PUBLIC COMMENTS**

## **APPENDIX B**

### **SUMMARY OF QUESTIONS FROM 28 JULY 99 PUBLIC MEETING**

#### **Site 19**

##### **Have we found any contaminants in the groundwater?**

*Polychlorinated Biphenyl's were not found in groundwater sampling; however, groundwater investigations have indicated several metals which have exceeded U.S. EPA Region III screening criteria (i.e., aluminum, arsenic, barium, beryllium and vanadium), and maximum contaminant levels (MCLs) for beryllium and lead. Organic compounds, specifically phthalates were detected, however, none were above MCL's and one (dibenz(a,h)anthracene) was above a screening level. The final assessment for groundwater will be done in conjunction with a nearby adjacent site (Site 40) in the near future.*

##### **Where is Site 19 relative to other buildings?**

*Site 19 is located in the south-central portion of the NSWCDL property, approximately 150 feet east of Caskey Road. Building 120B Defense Reutilization and Marketing Office (DRMO) lot is located nearby on the northeast portion of the site. The outside storage area of the DRMO lot is designated as Site 40. Site 40 is planned for investigation as outlined in the Site Management Plan. A temporary clinic is located southeast of the site approximately 200 feet away.*

#### **Site 29**

##### **Has there been any Indications of heavy metal contamination at this site?**

*Soil samples collected indicated the following contaminants; antimony, arsenic, iron, lead, mercury and total petroleum hydrocarbons. These contaminants were excavated during a Removal Action conducted in 1997. These contaminants were removed to the target cleanup levels, except for arsenic. It was determined that remaining arsenic levels were safe and similar to background levels.*

##### **Where were excavated soils taken during the Removal Action of the site?**

*Soil from Site 29 was excavated and transported to the permitted King & Queen Landfill located in Little Plymouth, Virginia for disposal.*



1 NAVAL SEA SYSTEMS COMMAND

2 NAVAL SURFACE WARFARE CENTER  
3 DAHLGREN DIVISION

4 PUBLIC MEETING

5 THURSDAY, JULY 28, 1999, 7:00 P.M.  
6 KING GEORGE COUNTY COURTHOUSE  
7 KING GEORGE, VIRGINIA

8 PROPOSED REMEDIAL ACTION PLAN  
9 Site 19, Transformer Draining Area  
10 Site 29, Battery Service Area  
11 Site 25, Pesticide Rinse Area

12 USEPA Region III  
13 Hazardous Site Cleanup Division  
14 Federal Facilities Section  
15 Mr. Bruce Beach  
16 1650 Arch Street, Philadelphia, Pennsylvania 19107

17 Virginia Department of Environmental Quality  
18 Mr. David Gillispie  
19 629 East Main Street, Richmond, Virginia 23219

20 Public Affairs Office  
21 Commander, Naval Surface Warfare Center  
Ms. Jennifer Wilkins  
17320 Dahlgren Road, Mail Code CD06 Dahlgren, Virginia 22448

Reported by: Lola Gail Serrett

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FRANCES K. HALEY & ASSOCIATES, Court Reporters  
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PHONE: (540) 898-1527 FAX: (540) 898-6154

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1 July 28, 1999:

2 MS. SWOPE: Good evening, everyone.

3 I want to welcome you tonight to our public meeting  
4 that we're having for the public comment period  
5 which announces proposed remedial actions for three  
6 sites at the Naval Surface Warfare Center, that the  
7 Navy, the Commonwealth of Virginia and the  
8 Environmental Protection Agency have chosen as the  
9 proposed plans that we would like to remediate these  
10 sites with. We're going to present a brief synopsis  
11 of that action to you tonight. You have - some of  
12 you have seen copies of the documents. They went  
13 down to the RAB members. They're also in the Smoot  
14 Library and the Dahlgren Library and we have copies  
15 on base, if you'd like to see it. The information  
16 is on the back on how to contact us with more  
17 questions. Yeah, they're in the back of the room.

18 Also, I want to introduce to  
19 Dave Misenhimer. He works for Tetrach, NUS. He's  
20 going to do the presentations tonight. He is  
21 probably the chief member of our contracting team

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1       that does all our investigations for us and most of  
2       the design work, all of his Tetrattech terms. So,  
3       Dave, I'll let you take it away.

4               MR. MISENHIMER: Okay.

5               MS. SWOPE: Oh, one more thing. I'm  
6       sorry. Just so you know, this is -- we have a court  
7       reporter here. We're recording everything tonight.  
8       Your comments are welcome, but we want to document  
9       those comments so we properly respond to your  
10      comments since this is a public comment period. So,  
11      feel free to interject wherever you have a question,  
12      concern or need clarification.

13              MR. MISENHIMER: Thank you. Okay.  
14      This machine is just beginning to warn up. But as  
15      Ann just said, there's two documents that are in the  
16      back of the room there. The first one deals with  
17      two sites, Site 19 and Site 29. And I'm going to go  
18      through Site 19 first, followed by Site 29. The  
19      second document deals with Site 25 entirely.

20              MS. SWOPE: That's reversed.

21              MR. MISENHIMER: I don't know what

1       happened here. Let's try this again.

2               MS. SWOPE: It was working  
3       beautifully, too.

4               MR. MISENHIMER: Yeah, it was  
5       working.

6               MR. FUSCALDO: You got a discount  
7       because it's upside down.

8               MS SWOPE: Exactly. You can show  
9       the location on the map.

10              MR. MISENHIMER: Yeah. The three  
11       sites that we're dealing with -- Site 19, is located  
12       right here. This is main side, here's 301, the  
13       Potomac River, Upper Machodoc Creek. So, Site 19 is  
14       kind of on the south side of main side. Site 29 is  
15       a little further south, over here. And Site 25 is  
16       located on the drain swell here that feeds into  
17       Upper Machodoc Creek.

18              Now, it's working. Okay. I  
19       don't know what happened. Anyway, so we're going to  
20       start out with Site 29 -- Site 19. And both, Site  
21       19 and 29, are grouped together because these are

1 two sites where we did some remedial action in the  
2 past and we're proposing that no further action be  
3 taken upon those two sites; whereas, Site 25, we  
4 have not done any remedial action to date and we are  
5 proposing to do some remedial action. That's what  
6 we'll be focusing on today.

7 So, at Site 19, this was a  
8 transformer draining area. Transformers were  
9 drained on the ground and transformer oil typically,  
10 in the days when this occurred, had PCB oil in the  
11 transformers. PCBs were found to be a human health  
12 risk and they were present in the soil where the  
13 transformers were drained. So, in 1994, the PCB  
14 contaminated soil was removed.

15 MS. SWOPE: This site is right south  
16 of the sea plane hanger.

17 MR. MISENHIMER: Here's an aerial  
18 photo of the site. This area in red is Site 19.  
19 It's adjacent to Site 40, which is another site that  
20 is currently under investigation in the Installation  
21 Restoration Program at Dahlgren.

1 concrete pads, here, where they stored the  
2 transformers and this is generally the area where  
3 transformer oil was dumped. This area, in general,  
4 is fairly flat, so anything that was dumped out here  
5 didn't really move too far. Groundwater generally  
6 flows in this direction, to the east. And  
7 approximately a thousand gallons of transformer oil  
8 were dumped there in the past -- drained there in  
9 the past.

10 Here's a site photo. In fact,  
11 the concrete pad I pointed out to you is right here.  
12 Here's a monitoring well. The area where  
13 transformer oil was drained is over in this area and  
14 this is the area where, in 1994, the contaminated  
15 soil was removed. The area that was -- where the  
16 removal occurred was about twenty-five feet by  
17 seventy feet, in length and width. And the soil was  
18 removed down to a depth of approximately two feet.  
19 So, there were about a hundred and seventy-seven  
20 cubic yards of soil that were removed, in total,  
21 from the site. The target cleanup level for the PCB

1 contaminated soil was a residential land use value  
2 that US EPA has established, which is one part per  
3 million. And cleanup was successful in getting all  
4 the contaminated soil out of there and verification  
5 sampling verified that we reach that level.

6 MR. FUSCALDO: I mean, have the  
7 monitoring wells picked up anything?

8 MR. MISENHIMER: No, there's  
9 really -- well, one thing I should -- this is what I  
10 want to point out here. In terms of groundwater,  
11 because we have Site 40 very close by and that site  
12 is being investigated, we decide to address  
13 groundwater with that adjacent site when we look at  
14 that site. It didn't make a lot of sense to try and  
15 break one area up from the other. So --

16 MS. SWOPE: (interjecting) But we  
17 have not found PCBs in the groundwater.

18 MR. MISENHIMER: Right.

19 MR. FUSCALDO: The clinic is there  
20 someplace now, isn't it? The temporary clinic.

21 MS. SWOPE: Yes.

1 MR. FUSCALDO: Where is that on  
2 this -- in relation to --

3 MS. SWOPE: You go back to the  
4 hang on. I'll show him. Go back to the aerial  
5 photo. It is right -- right in here.

6 MR. FUSCALDO: Okay. All right.

7 CAPTAIN MAHAFFEY: That's a new  
8 building.

9 MS. SWOPE: Yeah.

10 MR. MISENHIMER: So, what we're  
11 proposing today is that the removal or cleanup that  
12 occurred in 1994 was sufficient and that no further  
13 action is required for the soils in that area, and  
14 that groundwater, again, as I said, be evaluated with  
15 an adjacent site. And that's pretty much all I was  
16 going to say about Site 19. Are there any  
17 questions?

18 MR. FUSCALDO: And Site 40, what was  
19 that again?

20 MS. SWOPE: That's a storage lot,  
21 scrap metal.



1                   MR. MISENHIMER: Now, let's see if I  
2                   can pull it up. Okay. Site 29 is the second site  
3                   we want to talk about today. This is an area where  
4                   an unlined neutralization pit received battery acid  
5                   from an area about where batteries were drained.  
6                   And in 1995, our remedial investigation suggested  
7                   that there were human health risks, potential risks  
8                   with heavy metals in the soils, so in 1997, the  
9                   neutralization pit and all the soil that surrounded  
10                  that neutralization pit was removed. Here's an  
11                  aerial photo. This area in red, within this area  
12                  here is where the neutralization pit was located and  
13                  it's --

14                 MS. SWOPE: (interjecting) It's the  
15                 corner between the heavy duty shop and the battery  
16                 shop, behind it, toward the community house.

17                 MR. MISENHIMER: And the surrounding  
18                 soil, which was removed. Just south of the site is  
19                 a cooling pond. The cooling pond, which is also  
20                 known as Site 55, is another installation  
21                 restoration site which is currently under investig-

1       gation. These buildings are in the transportation  
2       area and there's a lot of activity that goes on  
3       around there related to transportation, and public  
4       works.

5               Here's a site photo. The area  
6       that we have highlighted in red is essentially this  
7       area in here. The neutralization pit under-  
8       ground. It was covered over some years ago and  
9       covered with asphalt paving and -- so, we had to dig  
10      that up to find the neutralization put and remove  
11      any contaminated soil that surrounded it.

12             MR. FUSCALDO: Now, I remember  
13      this -- I don't know how many -- how many meetings  
14      ago it was that -- when this thing was detailed.

15             MS. SWOPE: When we did this work?

16             MR. FUSCALDO: And I'm just kind of  
17      wondering how -- how that's turned out, you know,  
18      has there been any other indication of heavy metal  
19      contamination in there?

20             MR. MISENHIMER: Well, what we did  
21      was the area that was excavated here was an area

1       that encompassed about twenty-two feet by about  
2       thirty-eight feet. We went down seven feet. Before  
3       we got started, we had some preliminary goals in  
4       terms of what kinds of levels were acceptable for  
5       metals in the soils. So, as we went along, we  
6       sampled the soil. If we weren't meeting our goal,  
7       we dug some more out until we got to the point where  
8       we felt we were okay. After that was completed and  
9       the sampling data came back, then we looked at the  
10      human health risks. We'd run the numbers that you  
11      typically do to evaluate human health risks and  
12      based on that analysis, it was determined that the  
13      soil was fine, as well as the groundwater on this  
14      site.

15               MS. SWOPE: When we removed that, we  
16      removed a couple of oil separators that were old, an  
17      old oil tank.

18               MR. MISENHIMER: Right, right. Yes.

19               MS. SWOPE: There was a lot of things  
20      in the area, so we got rid of it all together.

21               MR. FUSCALDO: I remember it was a

1 real bad site.

2 MS. SWOPE: Right.

3 MR. FUSCALDO: Like most of that old  
4 stuff is.

5 MR. MISENHIMER: Okay. So, the  
6 contaminants that we were concerned about are listed  
7 up here; antimony, arsenic, iron, lead and mercury.  
8 So, as I said, when the soil was removed, we took  
9 samples and these were the things that we were  
10 checking on. And then, when we did the risk  
11 assessment, we did it based on these contaminants.

12 So, in summary, we feel that  
13 there's no need for any further action on the soils  
14 at Site 29 and that, based on our evaluation of  
15 groundwater, there's no need for any action with  
16 groundwater. The groundwater is fine and we believe  
17 that we're done with this site, essentially. Yes?

18 MS. VAN DE WEERT: You keep saying  
19 the soils were removed. Where are they taken to?

20 MR. MISENHIMER: Oh, okay.

21 MS. VAN DE WEERT: Landfills?

1 MR. MISENHIMER: Yes. They're taken  
2 off-site to a landfill.

3 MS. SWOPE: Actually --

4 MR. FUSCALDO: (Interjecting) Well,  
5 it's an incinerator, isn't it?

6 MS. SWOPE: The PCB -- the PCB  
7 soil -- this soil went to a cement kiln, brick kiln,  
8 I think. And then, the PCB soil went to one of very  
9 few PCB facilities that either landfill it or burn  
10 it, depending on the concentration of PCBs. And  
11 they verify that when they get it there. There are  
12 very few that will accept that. It went out west by  
13 train.

14 MR. FUSCALDO: It just doesn't get  
15 moved somewhere also to be somebody else's problem?

16 MR. MISENHIMER: No.

17 MS. SWOPE: Right. But the primary  
18 thing here were -- essentially, any time you've got  
19 petroleum type products, it ends up being burned in  
20 a brick kiln a lot of times, so you got some  
21 valuable use out of it.

1 MR. MISENHIMER: Any more questions?

2 Okay. Our next site is Site 25, known as the  
3 pesticide rinse area. And this is an area where  
4 pesticide containers were rinsed outside and the  
5 containers were then -- whatever was left was  
6 spilled on the ground. And also, inside a building,  
7 there was a slop sink where containers were rinsed  
8 and this slop sink drained into a french drain. Our  
9 remedial investigation suggested there were human  
10 health and ecological concerns from pesticides and  
11 heavy metals in the soil and in the sediment.

12 This in an aerial photo and it  
13 shows you building 134, right here. This is the  
14 building where the slop sink was located and this is  
15 the french drain, so material would drain out here  
16 and infiltrate into the ground. The other area  
17 where the containers were rinsed was out in this  
18 area, here, and whatever was left in the container  
19 was then dumped on the ground out here. So, in our  
20 investigation, we were concerned about the french  
21 drain and any movement of any of the contaminants,

1 the pesticides that may be present there. And then,  
2 this area, here, where we know things were dumped on  
3 the ground.

4 The other thing I guess I wanted  
5 to point out on this slide is that this is a  
6 drainage through here. It's kind of an intermittent  
7 drainage way and it is -- a good portion of this has  
8 been delineated as a wetland area.

9 Upgrade, here, is the cooling  
10 pond, just to relate back to Site 29. Site 29 is  
11 somewhere over in this direction. The cooling ponds  
12 are over here. And this in Site 25. So,  
13 ultimately, any overland flow drains down in this  
14 direction and into the Upper Machodoc Creek.

15 This is a site photo. Looking  
16 towards the Potomac River and Upper Machodoc Creek  
17 over in this direction. This is part of the wetland  
18 area in here and this is a monitoring well.

19 Now, this diagram shows what the  
20 preferred alternative is and it may be difficult to  
21 see this in the back there, but on the handout, this

1        little handout here, it might be easier to follow.  
2        There's a green line here that outlines the wetland  
3        area and then, this solid line, here, outlines the  
4        area where we're proposing to excavate the  
5        contaminated soil and haul that off-site for  
6        disposal at a landfill.

7                There are also some hot spot  
8        areas identified. Here's one. Here's another one.  
9        And then, the french drain area, which would also be  
10       excavated and hauled off-wits for disposal. In this  
11       case, the material that would be hauled off would go  
12       to landfill and Used an a daily cover at a landfill.  
13       The levels of contaminants are not that high that it  
14       would require any treatment prior to going to a  
15       landfill.

16               After this area, here, is  
17       excavated, we're talking about going down to a depth  
18       of about two feet. In some hot spot areas  
19       identified here, we might be going down as far as  
20       four -- four or five toot. This area would then be  
21       regraded to -- back to the existing area and the



1 wetland area would be reestablished.

2 So, the preferred alternative is  
3 that we remove all the contaminated soil,  
4 reestablish the wetland, we're going to send the  
5 contaminated soil to an off-site landfill. And  
6 because of this, we would have a situation where no  
7 long term monitoring of the site would be necessary  
8 because we're removing all the contaminated soil.

9 Any questions on site 25?

10 MR. FUSCALDO: I guess -- yeah, how  
11 do you -- how do you determine that you removed all  
12 the contaminated soil? That's a hard thing to do at  
13 a site like that, isn't it?

14 MR. MISENHIMER: Okay. That's a good  
15 question. Whenever we do any excavation like this,  
16 part of the project is to verify what you have left  
17 after you've taken this out, the soil that's left is  
18 clean. And so, a verification sampling plan is  
19 prepared and then we go ahead and take samples. So,  
20 as you're excavating this, we will typically grid  
21 this area off and then take samples at different

1 points and based on those sampling results, we'll  
2 decide, okay, is it okay or do we need to remove  
3 some more soil.

4 MR. FUSCALDO: How do you work that  
5 site when it's so wet in there.

6 MS. SWOPE: We could it right now.

7 MR. FUSCALDO: Okay.

8 MR. MISENHIMER: That's a good point.

9 MR. FUSCALDO: That gives me an  
10 indication. Okay.

11 MR. MISENHIMER: But one of the  
12 things that we take into consideration is really the  
13 time of year in which we're trying to work. We'll  
14 try to make sure it's during a dry period. You  
15 know, there's no guarantees on that, as you well  
16 know. But apparently --

17 MR. FUSCALDO: (interjecting) August  
18 is supposed to be pretty wet.

19 MS. SWOPE: These are all proposed  
20 that we would do the work next fiscal year, so it  
21 will happen in 2000.

1 MR. FUSCALDO: Okay. All right.

2 MS. SWOPE: And the other thing is  
3 that when we remove that, we'd like to increase the  
4 wetland capacity there and make it even more  
5 beneficial as wetland and not replace -- you know,  
6 not have to haul in clean dirt, just regrade and  
7 make it a better wetlands.

8 MR. FUSCALDO: Good idea. Good idea.

9 MR. MISENHIMER: Any other questions?  
10 Okay.

11 MS. SWOPE: Do we want to have a  
12 formal comment period. You know, I'll take another  
13 minute for you to ask more questions that will be  
14 recorded and after that, we'll cut off the recorder.  
15 We have refreshments and you can ask us some more  
16 questions that you'd rather not be recorded.

17 MR. FUSCALDO: I'm personally  
18 finished.

19 MS. SWOPE: Okay. Patty, do you have  
20 any more questions?

21 MS. VAN DE WEERT: No.

1 MS. SWOPE: Anyone? Captain?

2 MR. MISENHIMER: One thing that I  
3 guess should be mentioned is that the comment period  
4 started last Wednesday.

5 MS. SWOPE: It was announced in the  
6 *Free Lance*.

7 MR. MISENHIMER: Right. And it goes  
8 for thirty days and the comment period ends  
9 August --

10 MS. SWOPE: 19th.

11 MR. MISENHIMER: August 19th.

12 MS. SWOPE: So, you are welcome to  
13 submit written comments to the locations on the back  
14 anytime before August 19th. If you think of  
15 something else or you pass the information to  
16 someone who has questions, we welcome any questions  
17 or comments. Anybody else? We'll officially close  
18 the comment period then.

19

20

21

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MEETING CONCLUDED AT 7:32 P.M.

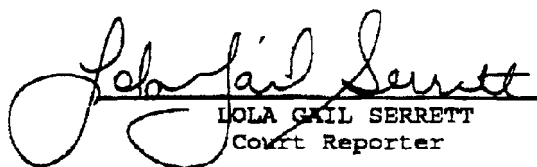
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CERTIFICATE OF COURT REPORTER

I, Lola Gail Serrett, hereby certify that I was the Court Reporter at the Public Meeting held at King George Courthouse, King George, Virginia, on July 28, 1999, at the time of the meeting herein.

I further certify that the foregoing transcript is a true and accurate record of the proceeding herein.

Given under my hand this 31st day of July, 1999.



LOLA GAIL SERRETT  
Court Reporter

FILE: POU2899L.HRG

FRANCES K. HALEY & ASSOCIATES, Court Reporters  
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**APPENDIX C**  
**TOXICITY PROFILES**

## APPENDIX C

### TOXICITY PROFILES - DAHLGREN, SITE 19

#### **ALUMINUM**

Aluminum is not generally regarded as an industrial poison. Inhalation of finely divided powder has been reported as a cause of pulmonary fibrosis. Aluminum in aerosols has been implicated in Alzheimer's disease. As with other metals, the powder and dust are the most dangerous forms. Most hazardous exposures to aluminum occur in refining and smelting processes. Aluminum dust is a respiratory and eye irritant. The USEPA has published an oral RfD of 1.00 mg/kg/day (IRIS) and an inhalation reference dose of 0.001 mg/kg/day (HEAST, 1997) for aluminum.

#### **AROCLOR 1260**

Hepatotoxicity is a prominent effect of PCBs, including Aroclor 1260, that has been well characterized. Effects include hepatic microsomal enzyme induction, increased serum levels of liver-related enzymes (indicative of hepatocellular damage), liver enlargement, lipid deposition, fibrosis, and necrosis. Chloracne and immune function disorders have been observed in humans and several animal species after PCB exposure. Reproductive and developmental effects, including low-birth weight, and decreased gestational time, and decreased reproductive capacity, have been observed in human and animal species.

Data are suggestive but not conclusive concerning the carcinogenicity of PCBs in humans. Hepatocellular carcinomas in three strains of rats and two strains of mice have led the EPA to classify PCBs as group B2, probable human carcinogen.

#### **ARSENIC**

The toxicity of inorganic arsenic (As) depends on its valence state (-3, +3, or +5), and also on the physical and chemical properties of the compound in which it occurs. Trivalent (As+3) compounds are generally more toxic than pentavalent (As+5) compounds, and the more water soluble compounds are usually more toxic and more likely to have systemic effects than the less soluble compounds, which are more likely to cause chronic pulmonary effects if inhaled.

The Reference Dose for chronic oral exposures, 0.0003 mg/kg/day, is based on a NOAEL of 0.0008 mg/kg/day and a LOAEL of 0.014 mg/kg/day for hyperpigmentation, keratosis, and possible vascular complications in a human population consuming arsenic-contaminated drinking water. Because of uncertainties in the data, U.S. EPA states that "strong scientific arguments can be made for various values within a factor of 2 or 3 of the currently recommended RfD value." The subchronic Reference Dose is the same as the chronic RfD, 0.0003 mg/kg/day.

Epidemiological studies have revealed an association between arsenic concentrations in drinking water and increased incidences of skin cancers (including squamous cell carcinomas and multiple basal cell Carcinomas), as well as cancers of the liver, bladder, respiratory and gastrointestinal tracts. Occupational exposure studies have shown a clear correlation between exposure to arsenic and lung cancer mortality. U.S. EPA has placed inorganic arsenic in weight-of-evidence group A, human carcinogen.

#### **CHROMIUM**

In nature, chromium (III) predominates over chromium (VI). Little chromium (VI) exists in biological materials, except shortly after exposure, because reduction to chromium (III) occurs rapidly. Chromium (III) is considered a nutritionally essential trace element and is considerably less toxic than chromium (VI).

Acute oral exposure of humans to high doses of chromium (VI) induced neurological effects, GI hemorrhage and fluid loss, and kidney and liver effects. An NOAEL of 2.5 mg chromium (VI) /kg/day in a one-year drinking water study in rats and an uncertainty factor of 300 was the basis of a verified RfD of 0.003 mg/kg/day for chronic oral exposure. An NOAEL (No effects were observed in rats consuming 5% chromium (III)/kg/day in the diet for over two years) of 1,468 mg/kg-day for chromium (III) and an uncertainty factor of 100 was the basis of the RfD of 1.5 mg/kg/day for chronic oral exposure.

Occupational (inhalation and dermal) exposure to chromium (III) compounds induced dermatitis. Similar exposure to chromium (VI) induced ulcerative and allergic contact dermatitis, irritation of the upper respiratory tract including ulceration of the mucosa and perforation of the nasal septum, and possibly kidney effects.

A target organ was not identified for chromium (III). The kidney appears to be the principal target organ for repeated oral dosing with chromium (VI). Additional target organs for dermal and inhalation exposure include the skin and respiratory tract.

## **IRON**

No toxicity information available. The RfD for iron (0.3 mg/kg/day) is based on allowable intakes rather than adverse effect levels.

## **MANGANESE**

Manganese is an essential trace element in humans that can elicit a variety of serious toxic responses upon prolonged exposure to elevated concentrations either orally or by inhalation. The central nervous system is the primary target. Initial symptoms are headache, insomnia, disorientation, anxiety, lethargy, and memory loss. These symptoms progress with continued exposure and eventually include motor disturbances, tremors, and difficulty in walking, symptoms similar to those seen with Parkinsonism. These motor difficulties are often irreversible.

Effects on reproduction (decreased fertility, impotence) have been observed in humans with inhalation exposure and in animals with oral exposure at the same or similar doses that initiate the central nervous system effects. An increased incidence of coughs, colds, dyspnea during exercise, bronchitis, and altered lung ventilatory parameters have also been seen in humans and animals with inhalation exposure.

A chronic and subchronic RfD for drinking water has been calculated by EPA from a human no observed adverse-effect level (NOAEL). The NOAEL was determined from an epidemiological study of human populations exposed for a lifetime to manganese concentrations in drinking water ranging from 3.6-2300 µg/L. A chronic and subchronic RfD for dietary exposure has been calculated by EPA from a human NOAEL which was determined from a series of epidemiological studies. A reference concentration (RfC) for chronic inhalation exposure was calculated from a human LOAEL for impairment of neurobehavioral function from an epidemiological study.

## **VANADIUM**

Vanadium is a metallic element that occurs in six oxidation states and numerous inorganic compounds. Vanadium is used primarily as an alloying agent in steels and non-ferrous metals. Vanadium compounds are also used as catalysts and in chemical, ceramic or specialty applications. Vanadium compounds are poorly absorbed through the gastrointestinal system but slightly more readily absorbed through the lungs. Absorbed vanadium is widely distributed in the body, but short-term localization occurs primarily in bone, kidneys, and liver.

The toxicity of vanadium depends on its physico-chemical state particularly on its valence state and solubility. In animals, acutely toxic oral doses cause vasoconstriction, congestion and fatty degeneration of the liver, congestion and focal hemorrhages in the lungs and adrenal cortex. Minimal effects seen after subchronic oral exposures to animals include diarrhea, altered renal function, and decreases in



erythrocyte counts, hemoglobin, and hematocrit . In humans, intestinal cramps and diarrhea may occur following subchronic oral exposures. These studies indicate that for subchronic and chronic oral exposures the primary targets are the digestive system, kidneys, and blood.

The reference dose (RfD) for chronic oral exposures to vanadium is 0.007 mg/kg/day. Inhalation exposures to vanadium and vanadium compounds result primarily in adverse effects to the respiratory system. There is little evidence that vanadium or vanadium compounds are reproductive toxins or teratogens. There is also no evidence that any vanadium compound is carcinogenic; however, very few adequate studies are available for evaluation. Vanadium has not been classified as to carcinogenicity by the U.S. EPA.

## TOXICITY PROFILES - DAHLGREN, SITE 29

### **ALUMINUM**

Aluminum is not generally regarded as an industrial poison. Inhalation of finely divided powder has been reported as a cause of pulmonary fibrosis. Aluminum in aerosols has been implicated in Alzheimer's disease. As with other metals, the powder and dust are the most dangerous forms. Most hazardous exposures to aluminum occur in refining and smelting processes. Aluminum dust is a respiratory and eye irritant. The EPA has published an oral RfD of 1.00 mg/kg/day (IRIS) and an inhalation reference dose of 0.001 mg/kg/day (HEAST, 1997) for aluminum.

### **ARSENIC**

The toxicity of inorganic arsenic (As) depends on its valence state (-3, +3, or +5), and also on the physical and chemical properties of the compound in which it occurs. Trivalent (As+3) compounds are generally more toxic than pentavalent (As+5) compounds, and the more water soluble compounds are usually more toxic and more likely to have systemic effects than the less soluble compounds, which are more likely to cause chronic pulmonary effects if inhaled.

The Reference Dose for chronic oral exposures, 0.0003 mg/kg/day, is based on a NOAEL of 0.0008 mg/kg/day and a LOAEL of 0.014 mg/kg/day for hyperpigmentation, keratosis, and possible vascular complications in a human population consuming arsenic-contaminated drinking water. Because of uncertainties in the data, U.S. EPA states that "strong scientific arguments can be made for various values within a factor of 2 or 3 of the currently recommended RfD value." The subchronic Reference Dose is the same as the chronic RfD, 0.0003 mg/kg/day.

Epidemiological studies have revealed an association between arsenic concentrations in drinking water and increased incidences of skin cancers (including squamous cell carcinomas and multiple basal cell Carcinomas), as well as cancers of the liver, bladder, respiratory and gastrointestinal tracts. Occupational exposure studies have shown a clear correlation between exposure to arsenic and lung cancer mortality. U.S. EPA has placed inorganic arsenic in weight-of-evidence group A, human carcinogen.

### **BENZENE**

Benzene is absorbed via ingestion, inhalation, and skin application. Humans may absorb benzene vapors through the skin as well as the lungs; of the total dose absorbed by the two routes, an estimated 22-36% enters the body through the skin.

Limited data show that nonlethal oral doses of benzene can impact the nervous, hematological, and immunological systems. As with orally administered benzene, the targets for nonlethal concentrations of inhaled benzene include the nervous, hematological, and immunological systems. Subchronic and chronic exposures to benzene vapors induce a progressive depletion of the bone marrow and dysfunction of the hematopoietic system. Benzene may also have long-term effects on the central nervous system. Workers exposed to benzene for 0.5 to 4 years exhibited EEG changes and atypical sleep activity consistent with neurotoxicity. Others exposed to benzene concentrations of 210 ppm for 6-8 years had peripheral nerve damage. Benzene does produce developmental effects (fetal toxicity, but not malformations) in the offspring of treated animals.

Benzene is carcinogenic in humans and animals by inhalation and in animals by the oral route of exposure. Occupational exposure to benzene has been associated mainly with increased incidences of various leukemias among workers.

Based on "several studies of increased incidence of nonlymphocytic leukemia from occupational exposure, increased incidence of neoplasia in rats and mice exposed by inhalation and gavage benzene

has been placed in the EPA weight-of-evidence classification A, human carcinogen. The oral and inhalation slope factors for benzene are  $0.029 \text{ (mg/kg/day)}^{-1}$

### **BENZO [A]PYRENE (BAP)**

Benzo (a)pyrene is the most extensively studied member of polynuclear aromatic hydrocarbons (PAHs), inducing tumors in multiple tissues of virtually all laboratory species tested by all routes of exposure.

Benzo (a)pyrene is readily absorbed across the GI and respiratory epithelia. Benzo (a)pyrene was distributed widely in the tissues of treated rats and mice, but primarily to tissues high in fat, such as adipose tissue and mammary gland.

Human data specifically linking benzo[a]pyrene (BAP) to a carcinogenic effect are lacking. There are, however, multiple animal studies in many species demonstrating BAP to be carcinogenic following administration by numerous routes. In addition, BAP has produced positive results in numerous genotoxicity assays.

The data for animal carcinogenicity is sufficient. Repeated BAP administration has been associated with increased incidences of total tumors and of tumors at the site of exposure. Benzo [a]pyrene has been shown to cause genotoxic effects in a broad range of prokaryotic and mammalian cell assay systems.

The verified a slope factor for oral exposure to benzo(a)pyrene of 7.3 per mg/kg/day, based on several dietary studies in mice and rats. Neither verified nor provisional quantitative risk estimates were available for the other PAHs in Group B2.

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A chronic and subchronic RfD for drinking water has been calculated by USEPA from a human no observed adverse-effect level (NOAEL). The NOAEL was determined from an epidemiological study of human populations exposed for a lifetime to manganese concentrations in drinking water ranging from 3.6-2300 µg/L. A chronic and subchronic RfD for dietary exposure has been calculated by USEPA from a human NOAEL which was determined from a series of epidemiological studies. A reference concentration (RfC) for chronic inhalation exposure was calculated from a human LOAEL for impairment of neurobehavioral function from an epidemiological study.

## **NICKEL**

Nickel is a naturally occurring element that may exist in various mineral forms. It is used in a wide variety of applications including metallurgical processes and electrical components, such as batteries. Some evidence suggests that nickel may be an essential trace element for mammals. The absorption of nickel is dependent on its physicochemical form, with watersoluble forms being more readily absorbed. Toxic effects of oral exposure to nickel usually involve the kidneys with some evidence from animal studies showing a possible developmental/reproductive toxicity effect.

Inhalation exposure to some nickel compounds will cause toxic effects in the respiratory tract and immune system. Acute inhalation exposure of humans to nickel may produce headache, nausea, respiratory disorders, and death. Asthmatic conditions have also been documented for inhalation exposure to nickel. No clinical evidence of developmental or reproductive toxicity were reported for women working in a nickel refinery, but possible reproductive and developmental effects in humans of occupational exposure to nickel have been reported. Furthermore, sensitivity reactions to nickel are well documented and usually involve contact dermatitis reactions resulting from contact with nickel-containing items such as cooking utensils, jewelry, coins, etc.

A chronic and subchronic oral reference dose (RfD) of 0.02 mg/kg/day for soluble nickel salts is based on changes in organ and body weights of rats receiving dietary nickel sulfate hexahydrate for 2 years. The primary target organs for nickel-induced systemic toxicity are the lungs and upper respiratory tract for inhalation exposure and the kidneys for oral exposure. Other target organs include the cardiovascular system, immune system, and the blood.

## **ZINC AND ZINC COMPOUNDS**

Zinc is an essential element with recommended daily allowances ranging from 5 mg for infants to 15 mg for adult males. Zinc is present in all tissues with the highest concentrations in the prostate, kidney, liver, heart, and pancreas.

In humans, acutely toxic oral doses of zinc cause nausea, vomiting, diarrhea, and abdominal cramps and in some cases gastric bleeding. Gastrointestinal upset has also been reported in individuals taking daily dietary zinc supplements for up to 6 weeks. There is also limited evidence that the human immune system may be impaired by subchronic exposures.

Chronic oral exposures to zinc have resulted in hypochromic microcytic anemia associated with hypoceruloplasminemia, hypocupremia, and neutropenia in some individuals. Anemia and pancreatitis

were the major adverse effects observed in chronic animal studies. Teratogenic effects have not been seen in animals exposed to zinc; however, high oral doses can affect reproduction and fetal growth.

The reference dose for chronic oral exposure to zinc is under review by USEPA; the currently accepted RfD for both subchronic and chronic exposures is 0.3 mg/kg/day based on a decrease in erythrocyte superoxide dismutase (ESOD) in adult women after 10 weeks of zinc exposure. Zinc is placed in weight-of-evidence Group D, not classifiable as to human carcinogenicity due to inadequate evidence in humans and animals.